APR 14 1947

FACTORY

MANAGEMENT AND MAINTENANCE

APRIL 1947

IN TWO PARTS, PART TWO

INDUSTRIAL PLANT BUILDINGS

Thirteenth Annual Special Section

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A McGRAW-HILL PUBLICATION

How BETTER LIGHTING contributes *Importantly* *to* Better Employee Relations

A report on:
Procedures for the Correction of Plant Seeing Conditions
FACTS
A report on:
Lighting...the No. 1 Tool in Controlled Working Conditions
FACTS
A Report On:
Advancements in the Use of Light and Color To Improve Plant Lighting
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FACTS

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FACTORY

MANAGEMENT and MAINTENANCE

APRIL, 1947

IN TWO PARTS, PART TWO

ALFRED M. STAEHLE, Publisher — L. C. MORROW, Editor

INDUSTRIAL PLANT BUILDINGS

THIRTEENTH ANNUAL SPECIAL SECTION PRESENTED AS PART OF THE APRIL, 1947, ISSUE

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McGRAW-HILL PUBLISHING CO., INC.

James H. McGraw; Founder and Honorary Chairman. JAMES H. McGRAW, JR., President; CURTIS W. McGRAW, Senior Vice-President and Treasurer; JOSEPH A. GERARDI, Secretary; NELSON BOND, Director of Advertising; EUGENE DUFFIELD, Editorial Assistant to the President; J. E. BLACKBURN, JR., Director of Circulation.

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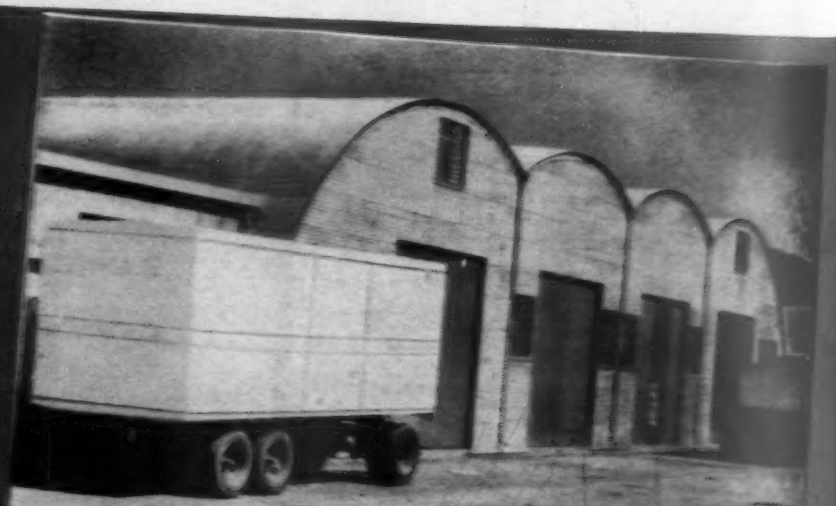
Quonset* 40

0' wide; length as required, in sections of 20'. Large sliding door, four windows and ventilating louvers, standard equipment in end walls. Extra windows available for side walls. Clear-span interior. Easy to insulate, ventilate and partition.

Quonset* MULTIPLE

width variable in increments of 20' 6"; length as required, in sections of 20'. Interior supporting columns spaced transversely at 20' 6" centers and longitudinally at 20' centers. Large double side sliding doors and ventilating louvers can be installed in end walls. Windows as required.



Plant building today is strongly influenced by such intangibles as employee and public relations. At American Paper Goods Company, Chicago, ready-made recreational facilities are available in the forest preserve just across the street

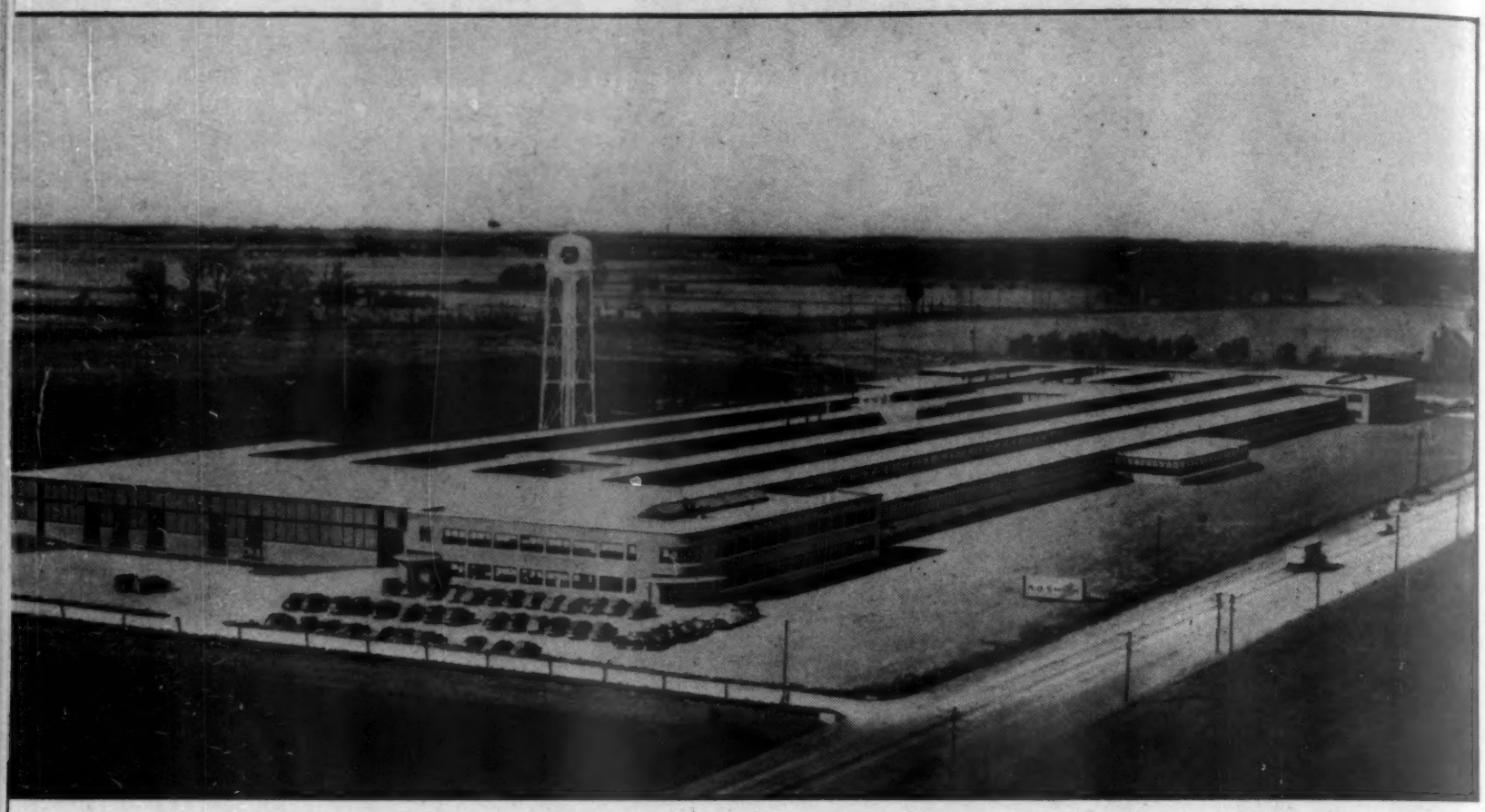
Austin photograph

INDUSTRY'S BUILDINGS AND LOW UNIT COSTS

Relaxation of government controls and increased availability of materials now make possible the erection of industrial plant buildings. During the war industry was handicapped by its inability to secure new structures, except where essential for the output of war matériel. Since V-J Day government controls and shortages in materials have retarded construction.

Of the effect upon economical production of buildings designed around the manufacturing processes, there is no doubt. Nor is there any question as to the necessity to reduce manufacturing costs by the introduction of the benefits of new buildings, as well as new and more productive manufacturing equipment.

The new building or the new plant, therefore, is something that must be considered widely in the manufacturing industries because of the greatly increased costs met on every side. In the long run, of course, the matter of building costs in relation to economies that can be made in production will be the determining factor in deciding whether to build or not to build. It will be influenced somewhat by the advantages of better working condi-



Radiant heating for A. O. Smith Corporation's big new plant at Kankakee, Ill., is supplied by 120 small hot-water heaters. Advantages include flexibility, cleanliness, and low-cost upkeep

tions as measured in employee satisfaction and morale. But the matter of costs cannot be dismissed without the most careful analysis.

Wage scales of skilled building tradesmen have advanced sharply, while prices of everything entering into an industrial plant building have advanced substantially. Taking the composite prices of all construction materials in 1939 as 100, the BLS index stood at 160.8 last November.

Once management has decided that it cannot afford *not* to build a new plant, or modernize its existing facilities, there are many details to be considered.

There is the matfer of strategic location of the old plant with respect to raw materials, labor supply, markets, transportation, housing, and recreational facilities for employees. New products, new markets, exhaustion of raw materials—any one of a dozen important elements may have changed adversely, to make the present location a handicap.

Advisability of decentralizing operations may well come up for discussion. Decentralization should result in smaller production units that lend themselves to easier control and higher efficiency. Also, it may enable advantage to be taken of better opportunities for plant expansion, improved housing for employees, more favorable location.

The question of whether it is possible to obtain more efficient layouts of production equipment, cut materials handling costs, and improve shipping and storage facilities in the old plant will loom large. An ideal layout placed alongside the best that can be had in the old plant will help to put the situation in its true light. If the present plant permits of no improvement in these matters, management must be prepared to do the best it can under a bad handicap. It must realize that the path of the high-cost producer will not be smooth in the years to come, nor will its prospects be bright.

Gaining Employee Good Will

Evaluation of the old plant from the standpoint of personnel and public relations is another matter that must not be dismissed lightly. Whether for better or worse, the time has long since passed when high-quality, efficient workers can be kept happy and satisfied in a down-at-the-heels, poorly lighted plant with primitive sanitary and other facilities. Time has passed, too, when a plant can continue to be an eyesore to the neighborhood, fostering public ill will. Genuine good will on the part of employees and public is an asset of high value. If the means of securing it cannot be found in the old plant, they can be built into a new one.

In this issue FACTORY throws the spotlight on some of industry's most important building problems and how they are being solved. From top management to plant engineer, there is great need to be well informed. The whole procedure of planning, designing, and building will go much faster and much smoother when plant men, architects, and engineers talk the same language.

TRENDS IN PLANT DESIGN AND CONSTRUCTION

Today's new industrial plant buildings develop to the maximum two wartime trends:

1. They are designed to capitalize fully on the intangibles of employee and public relations.

2. They are designed to increase productivity through their adaptability to production requirements.

The industrial plant building has become an integral part of modern manufacturing processes and as such it should be as up to date as is the company's product.

But high labor costs and material prices make economic considerations, in both construction and operation, the first problem for architects and engineers in the industrial building field. And, despite wartime publicity, new materials and new design principles have not been widely introduced. What is available, rather than what is being talked of, still dominates construction specifications. Architects and engineers expect, however, that new ideas will become increasingly important.

Accepting "human engineering" as a tool that must be planned for both inside and outside the plant, reports the Rust Engineering Company, Pittsburgh, the plants now being built will be centers utilizing the production abilities of workers at a higher level than before and enlisting public good will.

Perhaps the most obvious result of this trend is the tendency to decentralize, erecting two or more smaller plants at separate localities. In decentralized plants, definite limits are imposed on expansion, but not on the flexibility within each unit. Modern products, says the Rust Company, demand such exact production line requirements that the old arguments for savings in centralization are largely invalid.

To make employees "feel at home" while working, shower rooms are becoming more spacious; smoking rooms are provided at convenient points; conditioned air in locker rooms and ventilated lockers are widely accepted design features. Large-vision panels to bring an outdoor panorama to the inside of the plant are being incorporated even in glass-brick walls. Newly developed color codes guide painting to increase the safety, restfulness, and worker efficiency in many production areas.

One interesting trend, probably emphasized by 1946's strikes and shortages, was noted by Rust. Manufacturers are demanding "surge capacity units." To avoid interruptions in production, some executives are asking more storage space for each important item that comes into the plant. This space is planned to tide them over delays caused at the supply source or along the route and delays from shutdowns within the plant.

Additional capacity is added not

Light weight of aluminum roofing means lighter supporting structures. Panels are strong enough to support workmen. Non-rusting characteristic of aluminum eliminates costly maintenance

Austin photograph

Greater utilization of floor space is a "must" in modern factory design. Internal walls and doorways have been eliminated at American Paper Goods Company. Square feet were translated into cubic feet by providing for high piling of raw materials and finished goods by means of fork trucks and pallets

only in storage areas, but also at critical points along the production line itself. In wood pulp manufacturing, for instance, storage between stages, represented by stock chests, tanks, and hold-over reservoirs, has been more than doubled in the last ten years. Other industries are also increasing storage capacity in this way.

Traffic between shifts inside the plant as well as outside is receiving more consideration. To avoid confusion at shift-change time when "visiting" between incoming and outgoing workers slows traffic, Albert Kahn Associated Architects & Engineers has recently placed locker rooms and other employees' facilities between the entrance and production floor. Entrances, stairways, lockers, and other facilities are all unusually wide to provide areas in which workers on the incoming shift may congregate until the outgoing shift vacates the floor.

Less Walking

Other new designs incorporate elevated walkways and enclosed passages flanking the production floor to minimize traffic confusion. Escalators in multi-floor buildings speed interlevel traffic so that workers no longer have to depend on long stairways or slow freight elevators. In one new plant, individual-stall toilets have been located along the production floor at intervals of not more than 80 feet to shorten walking distances.

A new feature found in many plants is the installation of germicidal lamps in cafeterias, kitchens, locker rooms, and traffic points to combat common colds and other air-borne bacteria.

Recreational facilities are very frequently coordinated with community facilities today. Cost considerations and the return of peacetime recreation curtailed during the war make it important to consider the extent employees will use game rooms, baseball fields, and other recreational equipment before space is allocated to them. Most new plants provide in-plant food service facilities as a matter of course.

The many-sided improvements in factory design are reflected in trim, clean-cut exteriors. Designs take advantage of the opportunity to attract manpower and improve community relations by combining the simplest possible construction materials in a way that produces character and dignity with economy. Sites are selected to allow buildings to be set well back from the street. Lawns and landscaping are used to inspire pride not only among workers but also in the whole community.

Trends in structural design continue to emphasize increasing productivity. Gaining broader acceptance is the tendency to make a larger capital investment in plant or in facilities that will in the long run lower production and maintenance costs.

Glazed or colored ceramic tile walls, terrazzo floors, and elimination of dust-catching ledges or corners are extensively used features. Individual machinery supports and platforms are being studied to simplify factory interiors. Again, the building with lessened maintenance costs is axiomatically the more attractive one from the public and employee relations viewpoint.

Flexibility and adaptability are provided in the design through wider spans, fewer columns, and highly adaptable service installa-

tions. Overhead bus ducts for electrical services, grid systems from which steam may be taken at almost any point on the floor, and fluorescent lighting fixtures hung from messenger wires and providing high-intensity well-distributed light are widely used. Air conditioning is being specified in more and more plants, says Leo F. Caproni, New Haven, Conn., architect and engineer.

The use of welded trusses and other structural elements is well accepted, according to The Austin Company; H-section trusses in spans of more than 80 feet are expected to be broadly used.

At the same time, the growing use of lift trucks has been responsible for increasing clearances in many plants. Where plans five years ago might have called for 16-ft. clearances, many today call for heights of more than 20 feet. Adapting building design to changes in materials-stacking procedures is equivalent to the addition of 25 per cent of warehouse floor space.

Shortages in the supply of many traditional materials has led to exceptionally broad use of asbestos cement in sidewalls, and other specific materials. New materials have been introduced, but few of them have had the wide acceptance of glass fiber roofing which has been installed in a broad range of plants. New plastic, glass, and metal products, many of which are still in the development stage, are certain to figure prominently in the design of special building features and in some building equipment.

Greater Use of Metals

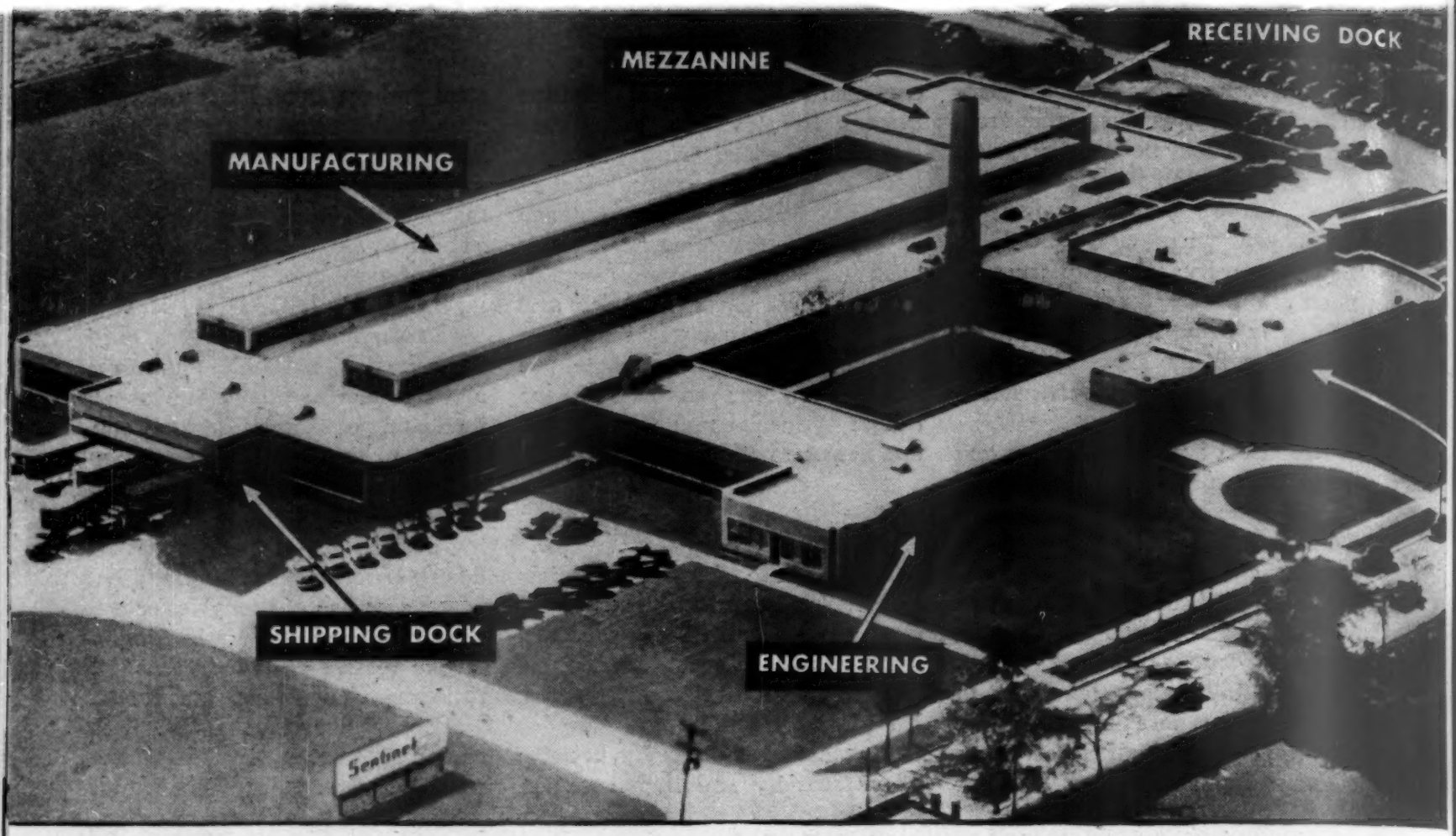
The basic load-bearing materials most widely used are still structural steel, wood, reinforced concrete, brick, and their variations, according to Lockwood Greene Engineers, New York. Wood is fast losing out to the other three, however, because of its scarcity and high cost. A greater use of metals is expected, particularly the corrosion-resisting metals when they become fully available.

These trends in materials are shown in the replacement of laminated wood arches and trusses with steel and concrete. Fireproofing of structural members is being given increasing emphasis, and this, too, means replacement of wood in many cases. In light roofs, for instance, long-span, lightweight slabs of gypsum or concrete are replacing wood plank. The H. K. Ferguson Company, Cleveland, notes the trend toward steel, aluminum, and lightweight alloys, the use of insulated panel units for wall construction, and the greater use of insulation for roof decks.

Reviewing new industrial building designs shows clearly that industry is doing its best to build into new factories functional effectiveness combined with a styling of simple masses and lines that will make them assets to the community.

Industry's awareness of these community values, if nothing else, will be a strong argument against putting plants underground. It may become necessary from the military viewpoint to build certain strategic plants into sidehills or the subsoil, but the underground plants will lose their capacity as good-will builders.

Wall tile with highly glazed finish means a good-looking plant. Exterior can be "laundered" at low cost. Shipping dock is under cover, permitting loading and unloading in any kind of weather



NEW SENTINEL PLANT WAS BUILT AND LANDSCAPED TO HARMONIZE WITH ITS RESIDENTIAL SURROUNDINGS

SENTINEL RADIO CORPORATION

NEW PLANT AT EVANSTON, ILL.

Sentinel's new plant, located on the outskirts of Evanston, Ill., is built around the straight-line production of radio sets. Raw materials are received on the west end of the plant, flow via straight continuous methods through one of four production lines, and emerge as completely finished radio sets ready for shipment. Nowhere along the line is there any *backtracking,* any *lost motion.*

The plant is located in the center of a 9-acre plot. It is 426 feet long with a single shift production capacity of 3000 radio sets per day. Approximately 125,000 square feet of floor space accommodates four continuous radio set assembly lines, each 250 feet long.

The building design is streamlined classic, ultra modern, using stone, brick, glass block, and stainless steel trim for all exterior detail. The main entrance lobby has decorative colored terrazzo floors, mirrored walls, stainless steel vestibule with non-glare glass doors. Another interesting feature is a flower and tree filled patio that helps in providing cross ventilation for offices and factory, as well as serving as an additional recreation area for employees.

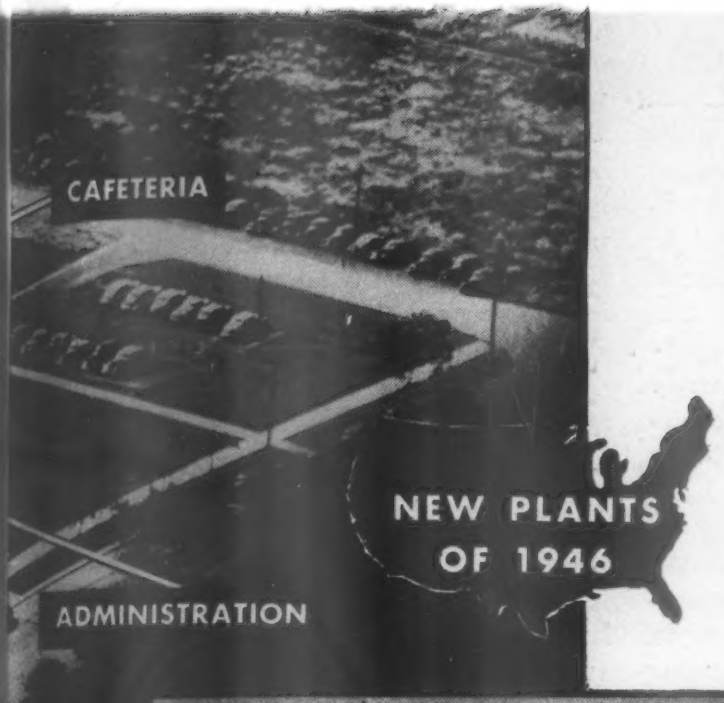
All production, engineering, research, and administrative functions are now housed in one building that formerly required three separate plants located in various parts of Evanston. As a result, operating costs are lowered and excessive materials handling has been eliminated.

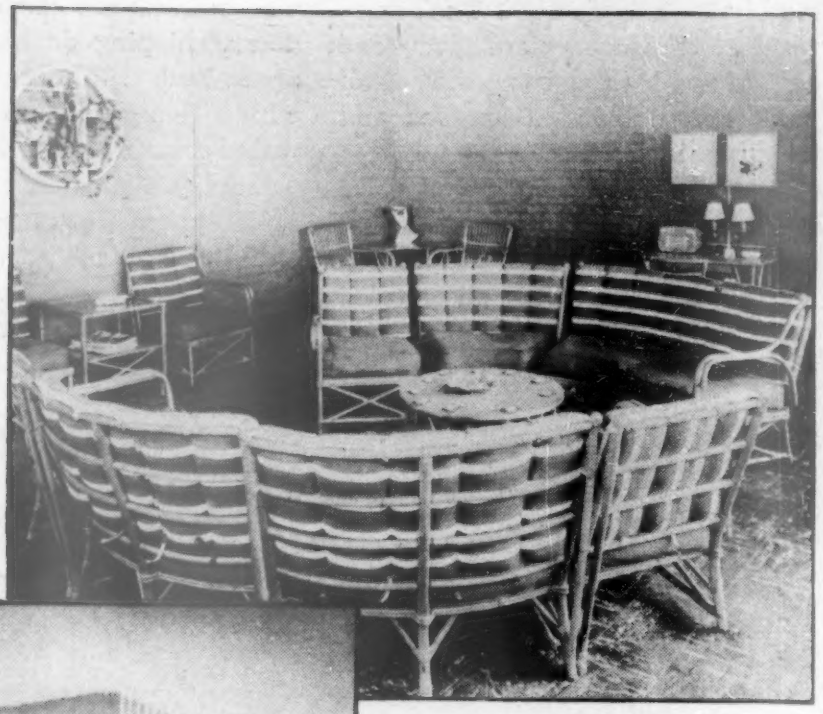
The factory is of the single story monitor type. Double monitors throughout the production area provide the maximum of natural daylight. Fluorescent lighting is used throughout the factory and office areas with a minimum of 20 foot-candles.

ENGINEER and BUILDER
●
RAGNAR BENSON, INC.
CHICAGO

Monitor mezzanines at the west end of the production lines house washrooms and toilet facilities complete with comfortable rest rooms. Central cloak rooms are adjacent to the employee's entrance. Each employee upon entering the plant must check in his coat and hat and then check them out upon leaving the plant at the close of his shift. This keeps the plant neater and prevents clothes being hung up all around in the plant. In the office, the same principle is applied, except that special recessed cloak closets are located centrally in the main hallway where office employees must hang their outer garments before starting work.

Floor covering in the offices is asphalt tile. Walls are plastered. Ceilings are acoustically treated





Well-appointed rest rooms, adjacent to toilet facilities, are located in monitor mezzanine. Thus there is no loss of valuable floor space, or of employees' time going to and from the production areas

All outside trim is stainless steel for easier maintenance as well as better appearance

and fluorescent lights are recessed. Office walls are finished with a soft pale pink paint which is restful and reduces glare. In the engineering design and drafting sections three-tube fluorescent light fixtures, mounted at a 45-deg. angle to the draftsmen, are used to eliminate stroboscopic effect.

Factory skylights are of the ventilating type with mechanical operating device consisting of a high speed worm and worm gear which is controlled from the floor level with a detachable loose rod crank. All sash used is of the puttyless type, using the tension type glazing caps which are secured to each supporting bar with non-ferrous

Glass used in the exterior windows at Sentinel Radio is of heat-absorbing, non-glare type. All service lines are above acoustically treated false ceiling

stud bolts and cap nuts. The structural steel frames were given one coat of red lead and one coat of oil paint before being assembled and the glass installed.

All exposed metal trimwork is of stainless steel which is not less than one-eighth inch thick. Aluminum thresholds are used for all exterior doors. Stainless steel channels and bottom rails are used for lobby glass doors. All joints are butted together and are watertight.

Heat Sources in Basement

Two oil-fired boilers are located in the basement and are connected to a unit heater system in the factory and a forced air system in the office area. All pipes are run underground to the factory and then brought up and carried overhead on the structural steel work. Unit heaters are of the projection, propeller, or blower type depending upon the location in the factory. The projection type is used where there are no drafts. The propeller type is used near windows where drafts are at a minimum, and the blower type is utilized in areas where drafts are bad, such as open doors, shipping docks, other draft areas. Each unit heater is connected with a thermostat that can be adjusted from the floor level.

Employee facilities were designed for comfort, attractiveness, and cleanliness. Rest rooms are provided where employees may enjoy their 10-minute morning and afternoon rest periods by having a smoke, a soft drink, a sandwich, or reading the latest magazines.

The spacious cafeteria for the employees was designed to accommodate 375 persons at one time. Breakfast is served each morning until shift starting time of 8:30 a.m. Tall, curved windows provide a beautiful view with pleasant and healthful conditions. Both the poured gypsum roof and the scientifically designed windows will aid in filtering out the hot rays of the summertime sunshine.

Special morning and evening bus services, connecting with the Chicago and Evanston elevated, bus and surface lines, discharge and pick up employees right at the property.

The 9-acre site is beautifully landscaped complete with lawns, trees, and appropriate shrubbery.

Cafeteria with a capacity of 375 employees is no less well appointed than the main offices. Breakfast as well as lunch is served, and workers can get snacks here during rest periods

High light from the continuous monitor is supplemented by gangs of fluorescents mounted with "T" brackets along the assembly lines. All service lines and unit heaters used in the factory area are overhead

SIMPLICITY THE KEYNOTE. THREE UNITS UNDER ONE ROOF. TOTAL FLOOR SPACE, 206,000 SQUARE FEET

GENERAL ELECTRIC COMPANY

NEW PLANT AT TIFFIN, OHIO

Good labor supply and availability of rail transportation were two of the major factors leading to the selection of Tiffin, Ohio, as the site of the new General Electric Company plant for the straight-line production of rotors and stators for fractional-horsepower motors.

The one-story, steel-frame, brick-faced building is 376x632 feet in plan, with column spacing of 40x60 feet. Minimum clearance, floor to lowest chord of the supporting trusses, is 15 feet. Roof trusses throughout are of the 60-ft. standard welded design developed by The Austin Company. Alternate trusses are supported by 40-ft. jack trusses of similar construction; assembled without gusset plates, they are composed entirely of H-beams which are cut to length and welded.

Plant actually comprises three separate units under one roof—administration (50x420 feet), general manufacturing (320x590 feet), and a controlled-conditions area (120x320 feet). A small water-treatment plant is a separate building, but the power house is part of the manufacturing building.

The controlled-conditions area includes the winding and assembly areas, and the packing department, where motor elements are wrapped after they emerge from the cleaning room. This section of the plant is set off by walls of flash tile, has strip maple floors, a full 2 inches of insulation on the metal deck roof. Atmosphere is maintained rigorously at 80 deg. F. (dry bulb), 67 deg. F. (wet bulb), 50 per cent relative humidity. Ventilating system produces 6.75 changes an hour by circulating air at the rate of 66,290 c.f.m. (outside air, 34 per cent). Air from this area is exhausted into the general manufacturing departments. These carefully pre-planned design specifications have held the maximum summer refrigeration load to just slightly over 200 tons.

ENGINEER and BUILDER
●
The AUSTIN COMPANY
CLEVELAND

Factory ventilation is provided by overhead unit heaters and unit ventilators, in conjunction with outside air intakes and power-driven roof ventilators. The arrangement is designed to provide about 22 complete changes of air per hour in the manufacturing areas. Office heating is provided by a low-pressure steam system using wall-hung convectors; there is no provision for air conditioning in the office areas.

In the interests of flexibility, all power distribution, compressed air, water, gas, and other service lines are carried overhead through the trusses. About 2500 feet of 400-amp., three-phase bus duct is used to distribute power throughout the plant. A three-conductor interlocking armored cable connects the bus duct and furnaces with three 2000-kva., double-ended, load-center substations, each of which is connected to the primary switchgear

with 5000-volt interlocking armored cable. The primary switchgear receives 4160-volt power from a three-unit, 69-kv., 5000-kw. substation through lead-covered cables installed in the underground duct lines.

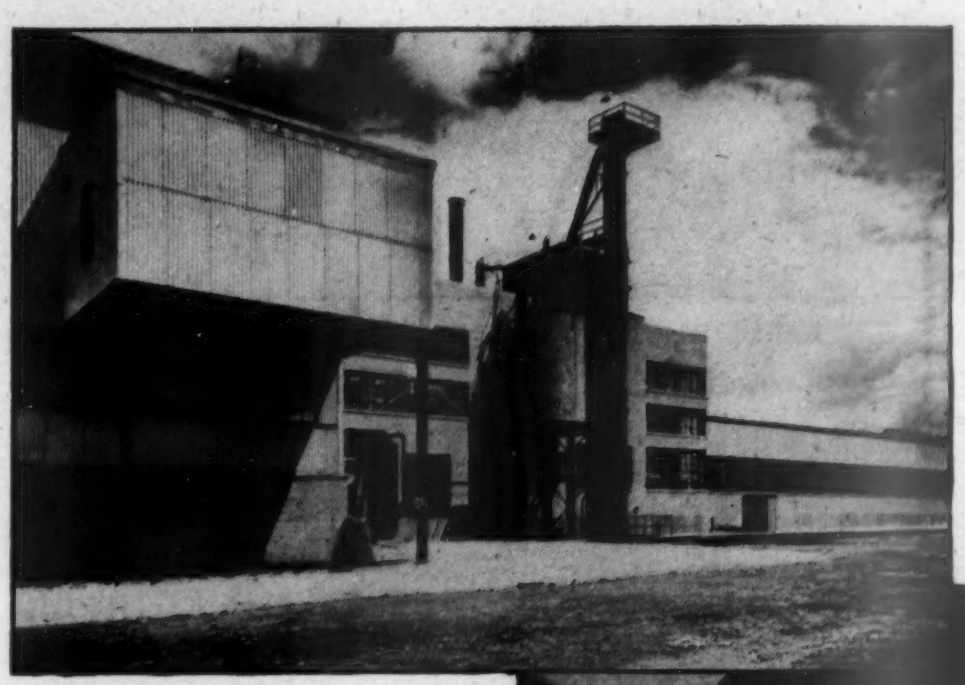
Continuous rows of two 100-watt, 265-volt, industrial fluorescent fixtures on 13-ft., 4-in., centers, mounted 14 feet above the floor, provide uniform illumination of about 45 foot-candles at the workplaces. The fixtures are controlled in areas 40x120 feet through push-button magnetic contactors and plug-in switches on the power bus duct. The fourth wire of the three-phase, 4-wire, 480/265-volt power distribution system is tapped to the ground-grid system.

A 110-volt a.c.-d.c. control circuit supplies power for process-control equipment, pilot lights for fire stations, and the emergency light system, which comes on automatically in case of a power failure to the plant.

Layout of the manufacturing areas was specified after a functional analysis of the needs of continuous flow handling through the several departments. Incoming materials are unloaded at floor level directly from boxcars or trucks to the enclosed siding and truck doors in the large receiving department in the northwest corner of the building. Here, 80-ft. welded trusses give two 15-ton cranes free access to all parts of the receiving area. The reinforced concrete floor has a load-carrying capacity of 4000 pounds per square foot.

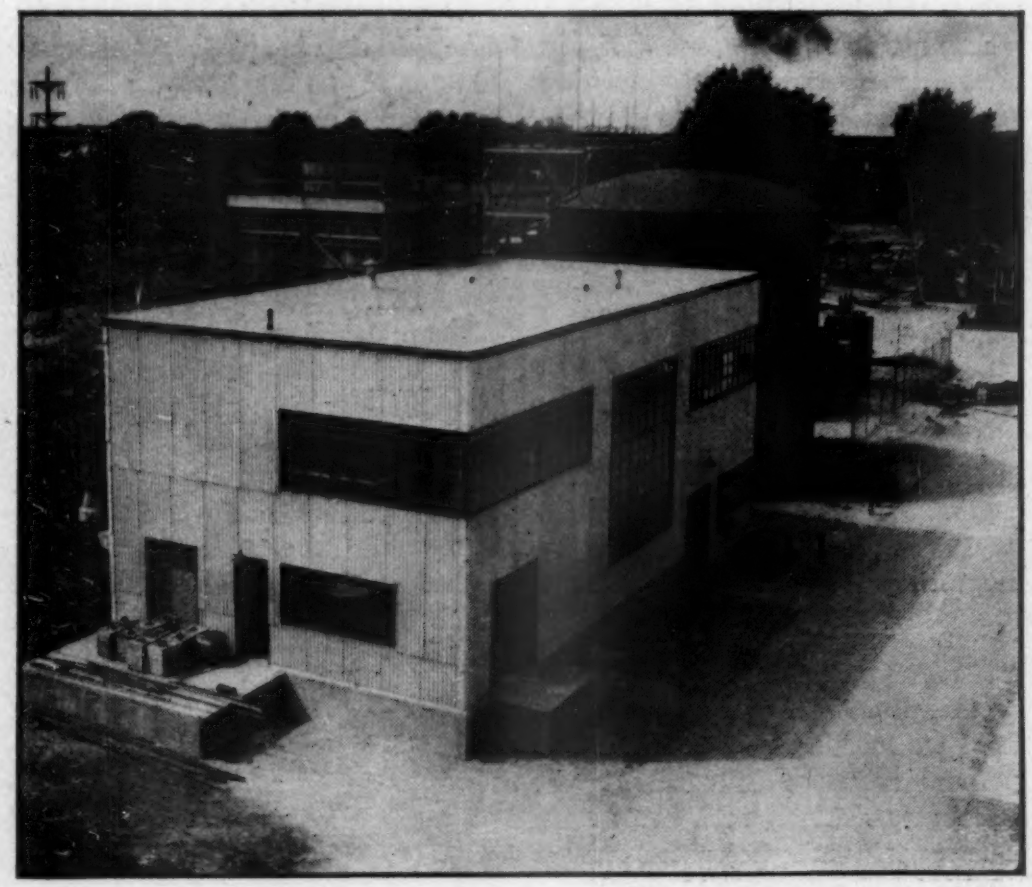
Floors in the general manufacturing departments are of creosote wood block. Unlike the pivoted steel sash in the brick walls of the office area, the factory windows are mounted in pivoted wood and steel sash. The deck roof has 1½-in. fiberboard insulation, covered by 20-year built-up tar and gravel roofing.

One of the outstanding features of this section is the ingenious underfloor system for scrap disposal. All metal scrap from blanking and punch presses drops through door openings directly behind the presses into an underground trench. The conveyor carries the material



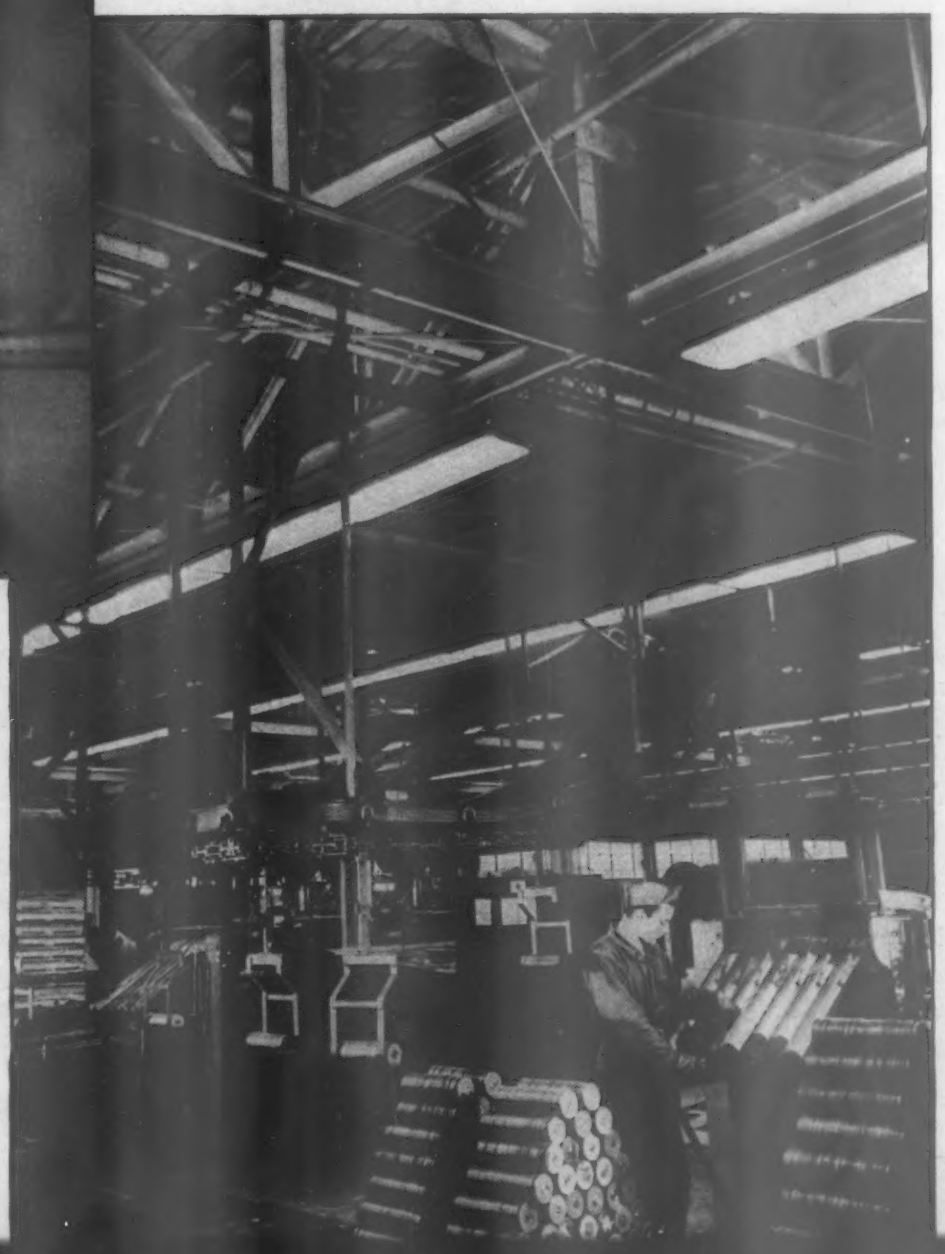
Projecting section at left, above, contains scrap hopper, which dumps directly into cars on the rail siding

Sheet metal hoods serve as air intakes; units in center of roof area house motor-driven exhaust fans. Insulated deck roof has a covering of 20-year built-up tar and gravel



Water-treatment plant is a separate building. Cooling tower is induced-draft type with two 600-g.p.m. pumps

Two of the six parallel production lines in the controlled-conditions area. Fluorescent lights provide about 45 foot-candles of illumination at the work level. Tile walls, strip maple flooring, fiberboard-insulated ceiling simplify control problem

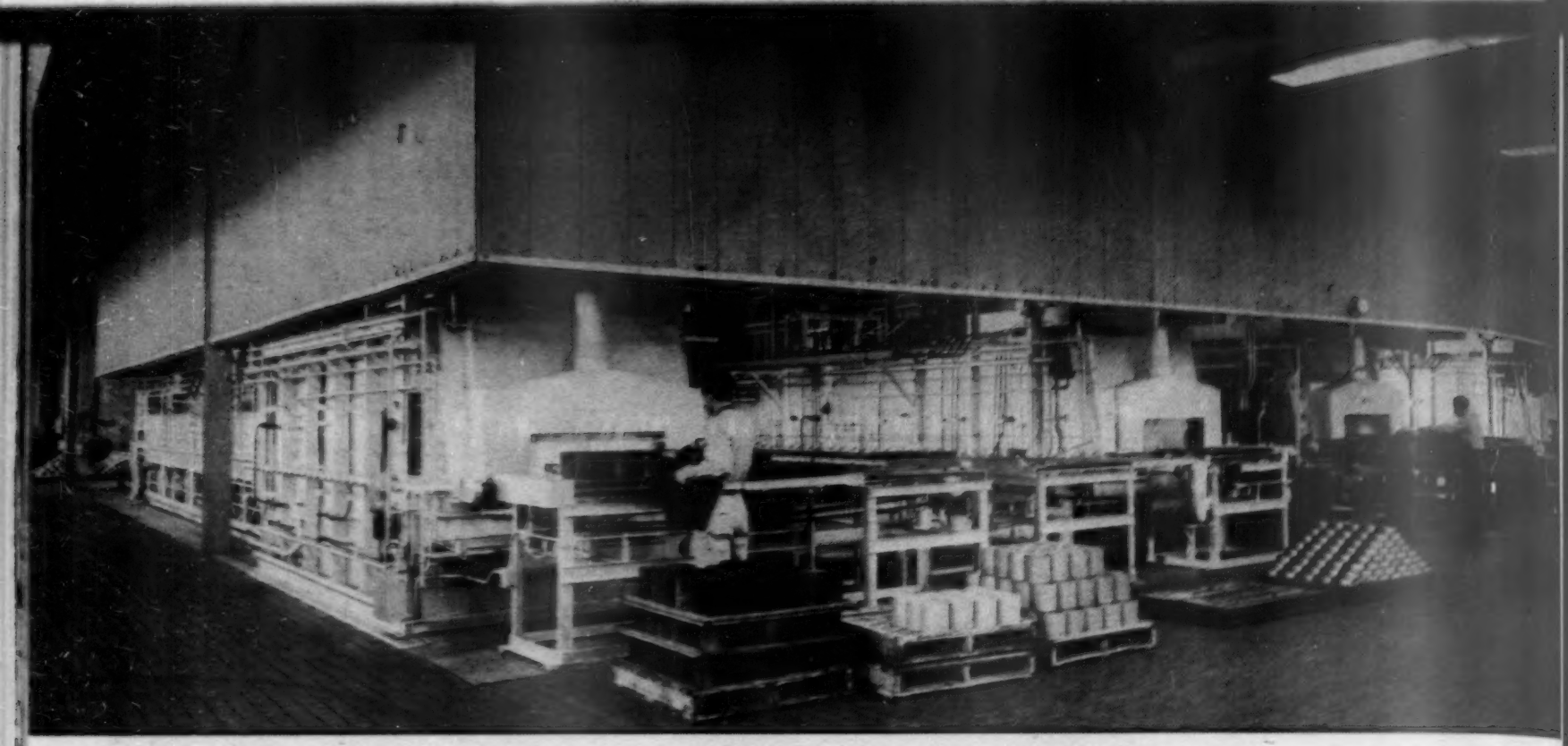


through the trench and transfers it to an elevated belt conveyor which crosses over the 80-ft. receiving bay to a large hopper directly above the scrap loading spur.

Temperatures in the areas adjacent to the large batteries of annealing furnaces are held down to the comfort level at all times by means of motor-operated roof ventilators and sheet-metal hoods which trap the heat and draw air from the distant and cooler parts of the area.

Roller and belt conveyors perform most of the heavy handling functions at the Tiffin plant, but monorail bridge cranes and hoists have been suspended from the trusses in almost every department, either for handling incoming raw materials or for interdepartmental handling of materials in process. In the controlled-conditions winding

H-trusses, used extensively in the building, are well adapted to overhead conveyor systems. Here, monorails have been suspended from the bottom chord of a 40-ft. jack truss without regard for panel points

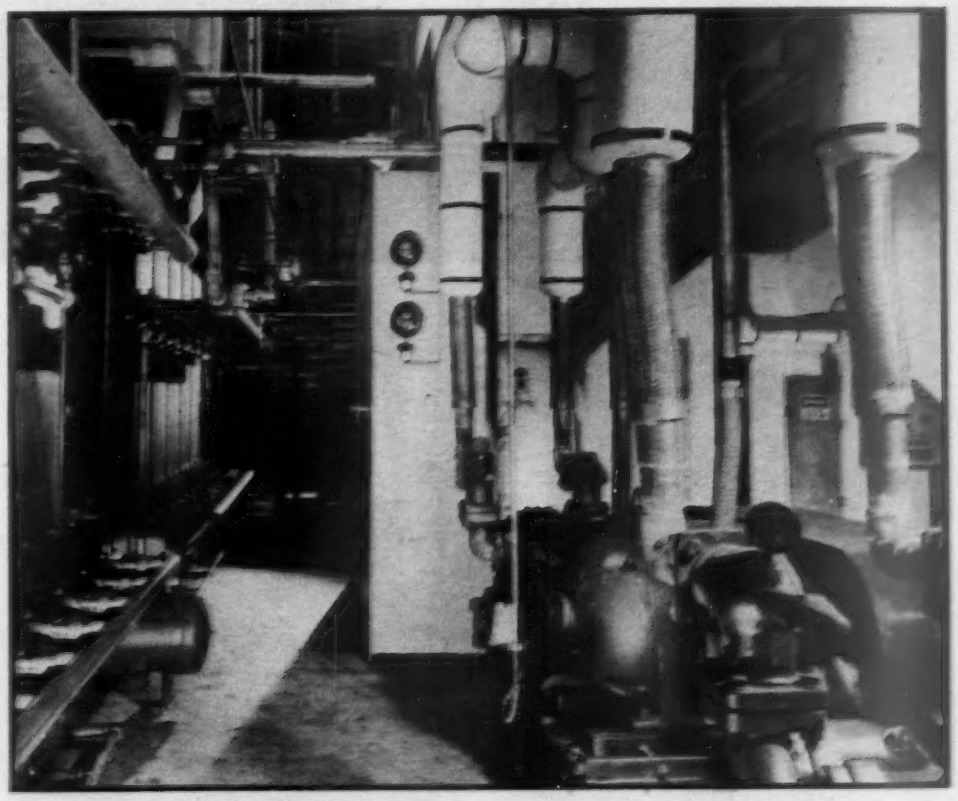


Curtains of sheet metal trap all the heat rising from the annealing furnaces. Motor-driven roof ventilators above the ovens draw air from the more remote parts of the floor, provide about 22 changes per hour

room, for example, belt conveyors at table height are supplemented by a network of monorails used to transport completed work to the cleaning and shipping departments.

To insure adequate foundation support, structural members are carried on concrete caissons. These were formed by drilling a 3-ft. hole into the hardpan usually found about 8 or 9 feet below the surface. The bottom of the hole was then belled out to a 5-ft. diameter, dowels were placed, and the opening was filled with concrete.

Steam for the plant is provided by two stoker-fired boilers, each capable of producing 15,000 pounds per hour at 130 p.s.i. gage pressure. Although present maximum usage is estimated at only 25,000 pounds per hour, provision was made for the installation of a third boiler if and when expansion of the plant increases the load beyond the capacity of the present generating system.



Equipment in the power house provides the 200 tons of refrigeration necessary for the controlled-conditions area during the warm summer months

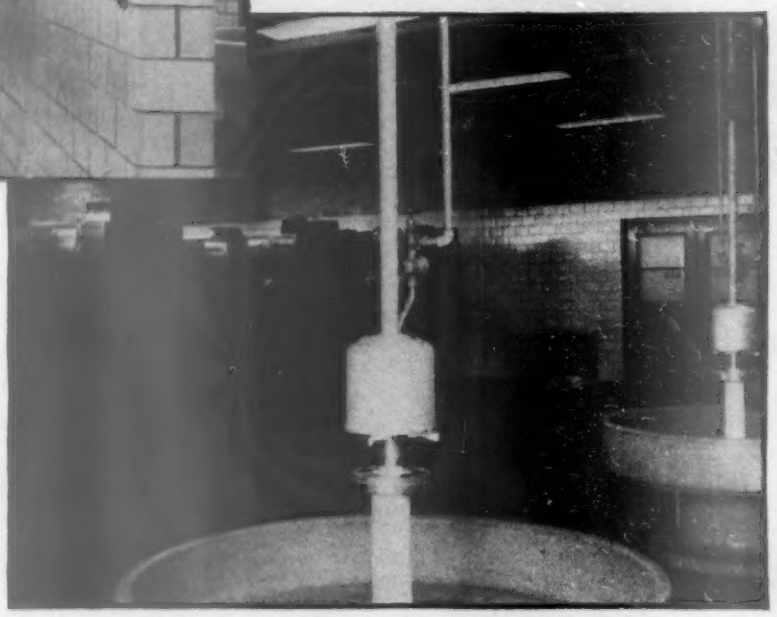
The stokers were mounted remotely from the boilers to permit a practically clear firing aisle in front of the boilers and to allow unobstructed access to the ashpit doors. The coal, delivered by rail, is brought to a track hopper in the siding. An apron conveyor carries it to a spaced-bucket elevator, which delivers it to a 200-ton bunker. The bunker discharges by gravity flow through individual gates to the stokers. Ash removal is achieved practically automatically by means of a steam-operated pneumatic-type system.

Water is obtained from wells and from a nearby river, and consequently requires treatment before it can be used either in the boilers or for the process machinery. This is done in a small, separate building across the siding which was constructed especially for this purpose.

Employee facilities have been provided on a liberal scale throughout the plant. The cafeteria and dispensary are conveniently located adjacent both to the offices and to the factory areas.

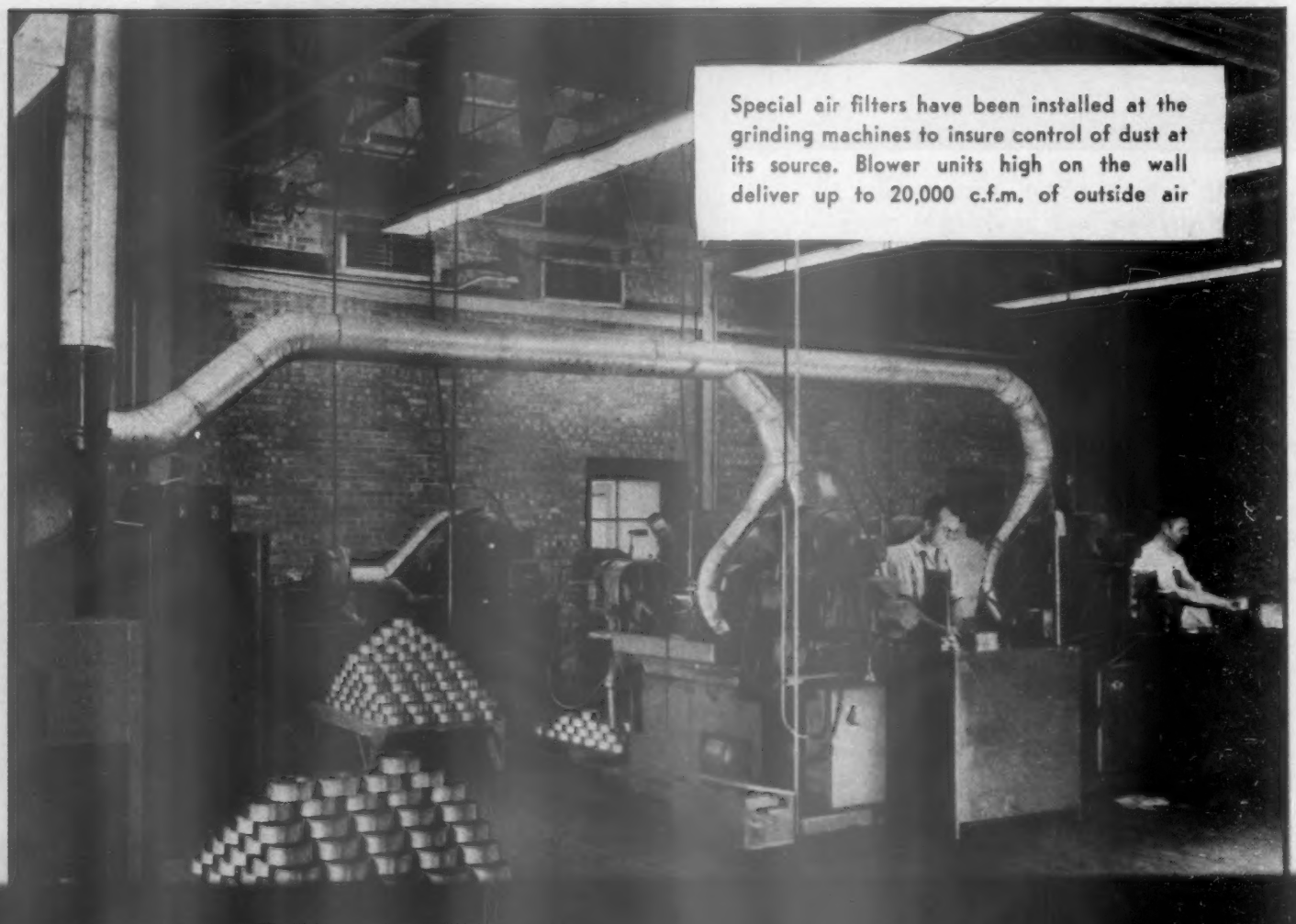
Floodlights on the building and nearby poles not only illuminate and beautify the building, but also serve another highly useful purpose in keeping the employees' parking lot well lighted.

Ductwork is arranged to keep a large volume of fresh air passing through the lavatories



Glazed tile to a height of 10 feet around men's locker rooms simplifies maintenance. Good light and air, lock boxes, gang washfountains

Cafeteria, close to production areas, is a clean, cheery place to eat



Special air filters have been installed at the grinding machines to insure control of dust at its source. Blower units high on the wall deliver up to 20,000 c.f.m. of outside air

UNITED STATES RUBBER COMPANY

NEW PLANT AT DETROIT

Newest unit of U. S. Rubber's Detroit plant makes full use of both gravity-flow and straight-line methods

Bus ducts are carried overhead from two separate substations to minimize distribution distance. Banks of similar machines, like those in the photograph, are supplied by plug-in; most others are controlled from the switchboards which are located in the basement substations

Additional capacity has been added to the Detroit plant of the United States Rubber Company with the completion of its new 4-story, 400,000-sq.-ft. building. Making fullest possible use of gravity-flow and straight-line production methods, a marked increase in efficiency is expected of the new structure.

Designed to become an integral part of the existing plant, each floor of the 493x165-ft. building is connected by covered bridges with the older units. These floor-level bridges are of structural steel, with reinforced concrete floors and sidewalls of insulated, corrugated asbestos. This arrangement permits interdepartmental transportation to proceed uninterrupted throughout the plant.

Completely fireproofed, the new building has a structural steel frame, brick sidewalls, and projected type steel sash. The front elevation has limestone trim to conform architecturally with the adjoining buildings in the unit.

Column spacing is 29x27 feet, and the concrete-slab floors are designed for live loads of from 250 to 400 pounds per square foot, depending upon requirements. Ceiling heights vary also, according to the occupancy of the floor, from 15 to 24 feet.

A 325,000-lb. calender, located on the first floor, is supported entirely on its own structural steel frame, independent columns transmitting the load to the building footings. This construction has proved highly efficient in isolating vibration.

General vertical transportation is accomplished by means of one elevator centrally located. Completely automatic, it has a normal operating capacity of 20,000 pounds, but provision has been made for carrying up to 37,000 pounds at slow speeds by special counterweight adjustments. This feature permits moving heavy machinery between floors without the expense of special rigging each time such a move is necessary.

Basement rooms which house the substation switchboards are mechanically ventilated, with evaporative cooling systems for summer operation

Large Exhaust Fans

The top-floor vulcanizing department was designed to combine functional utility with employee comfort. Large motor-driven exhaust fans have been placed in the roof directly above the machines, with one fan to every four vulcanizers. In addition, outside air is delivered by overhead ducts to outlet nozzles blowing directly in front of each machine. The air thus delivered has been washed and filtered, and provision has been made for tempering it in the winter months. The roof area in this department has been insulated with a 1-in. layer of fiberboard to add to the comfort of the room under summer conditions. The roof itself is of concrete slab construction, with a 5-ply tar and gravel topping.

Ventilating conditions similar to those on the top floor also obtain throughout the mill departments, with the addition of sheet metal hoods for the mills. The hoods are equipped with forced draft air exhausts which carry heat and fumes away from the operators.

One 6-in. and one 12-in. steam main from the central power plant supply all process and heating steam required in the building. Initial delivery is superheated steam at 200 pounds. The 6-in. main supplies the vulcanizers directly, while steam from the 12-in. main is de-superheated and reduced to 120 pounds for use as process steam. A further reduction to 10 pounds makes steam from the same source available for general heating purposes. In general, the manufacturing areas are tempered by the use of unit heaters.

Local Power Supply

Electrical energy is generated locally. The present connected load for lighting, and all building service and production machinery, is approximately 9410 kva., with provision made for increasing this load by 30 per cent if necessary.

Lighting loads, consisting of both incandescent and fluorescent fixtures, and a few fractional-horsepower motors, account for 885 kva. with practically a 100 per cent demand factor. This load is served by two 500-kva. transformers, and averages 2¼ watts per square foot. The lower lighting intensities, between 15 and 20 foot-candles, are

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●
LOCKWOOD GREENE ENGINEERS, Inc.
NEW YORK

obtained with incandescent fixtures. Fluorescent fixtures light the more critical areas, where 20 to 45 foot-candle intensities are required for both office and certain production illumination.

Small motor loads are connected to a 440-volt system fed by two 1000-kva. transformers. There are 500 such motors, ranging in size from fractional to 100 horsepower, totaling 3900 kva. connected load. Studies showed that an over-all demand factor of 40 per cent would not be exceeded by this load. One of the 1000-kva. transformers is now serving 2500 kva. of connected load. The second is reserved for future small motor loads.

High-Voltage Motors

Large motors are supplied individually by feeders from a 2300-volt system. There are 17 such motors ranging from 150 to 600 horsepower, with a connected load of 4600 kva. and an expected demand factor of 80 per cent.

To minimize distribution distances, two independent substations were installed in the basement. Each serves only the loads in the respective halves of the building, and is fed by its own group of 2300-volt underground feeders from the power plant.

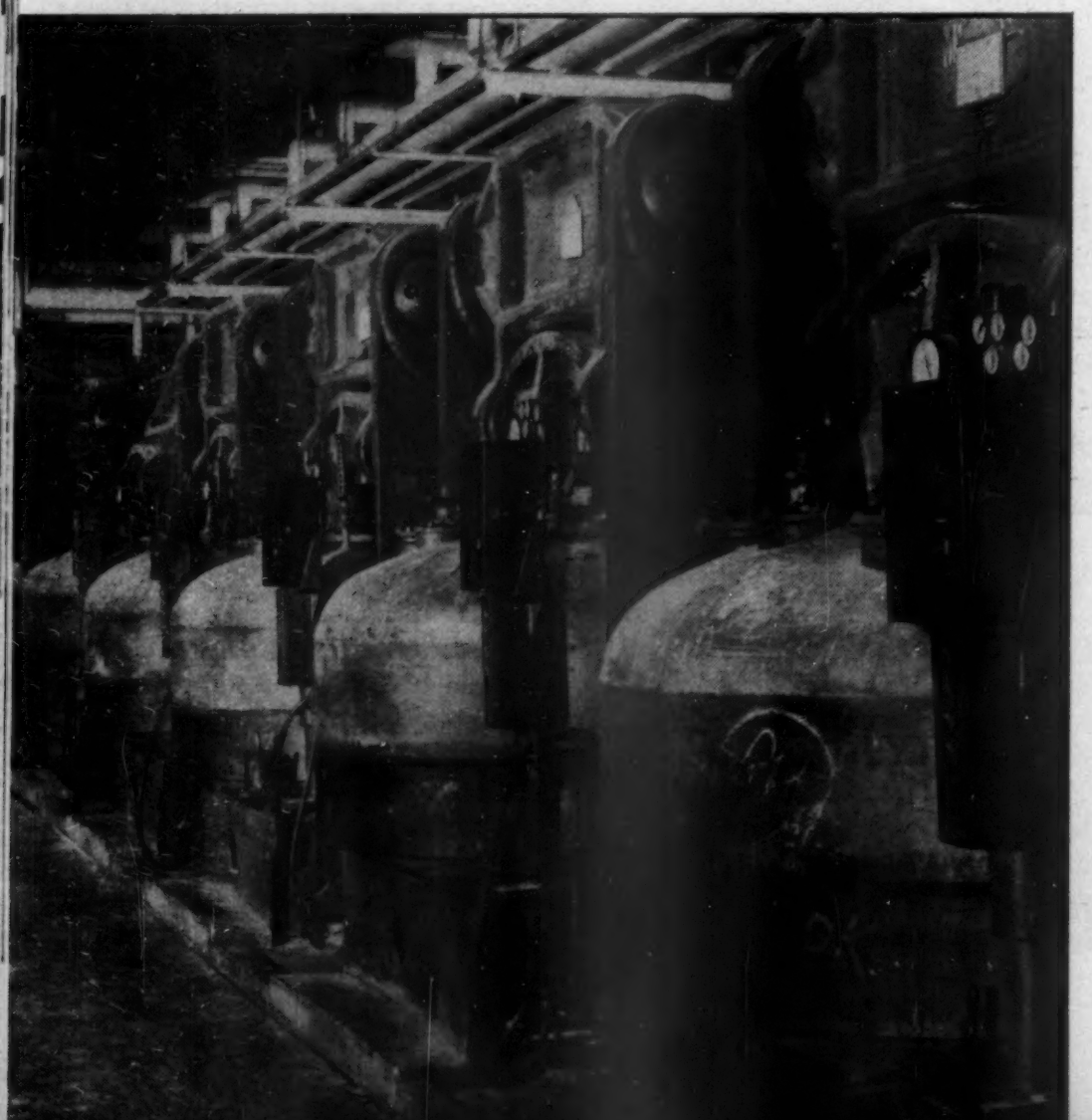
All 2300-volt motor controls are grouped within the substations, as are the 440-volt power, and 120/208-volt lighting transformers and their distribution switchboards. The substations are mechanically ventilated, with evaporative cooling systems that are used for summer operation.

Miscellaneous 440-volt motor loads are supplied from local distribution panels mounted on columns or walls, and located centrally among each group of 10 or 15 motors. Where a considerable number of the same type of equipment are uniformly spaced, the 440-volt motors are supplied by plug-in type bus duct located on the ceiling, if the ceiling heights are normal. Where abnormally high ceilings are encountered, the bus duct is located on the ceiling of the floor directly below.

In addition to housing the electrical control rooms, the basement is used also for storing molds and latex, and for the maintenance and repair departments.

Each floor of the plant has been amply provided with toilet, shower, and locker facilities. All such areas have structural glazed tile walls and terrazzo floors, and are well ventilated.

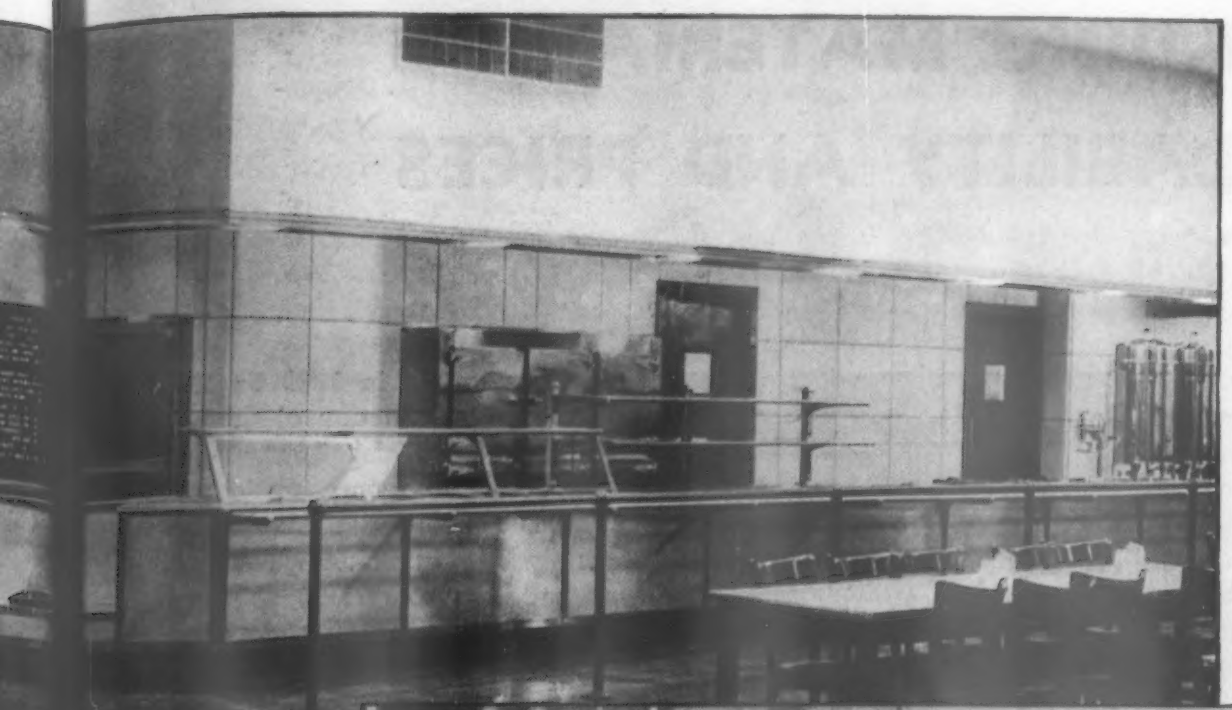
In the fourth floor vulcanizing room worker comfort is assured by having outside air delivered by overhead ducts to nozzles blowing directly in front of each machine



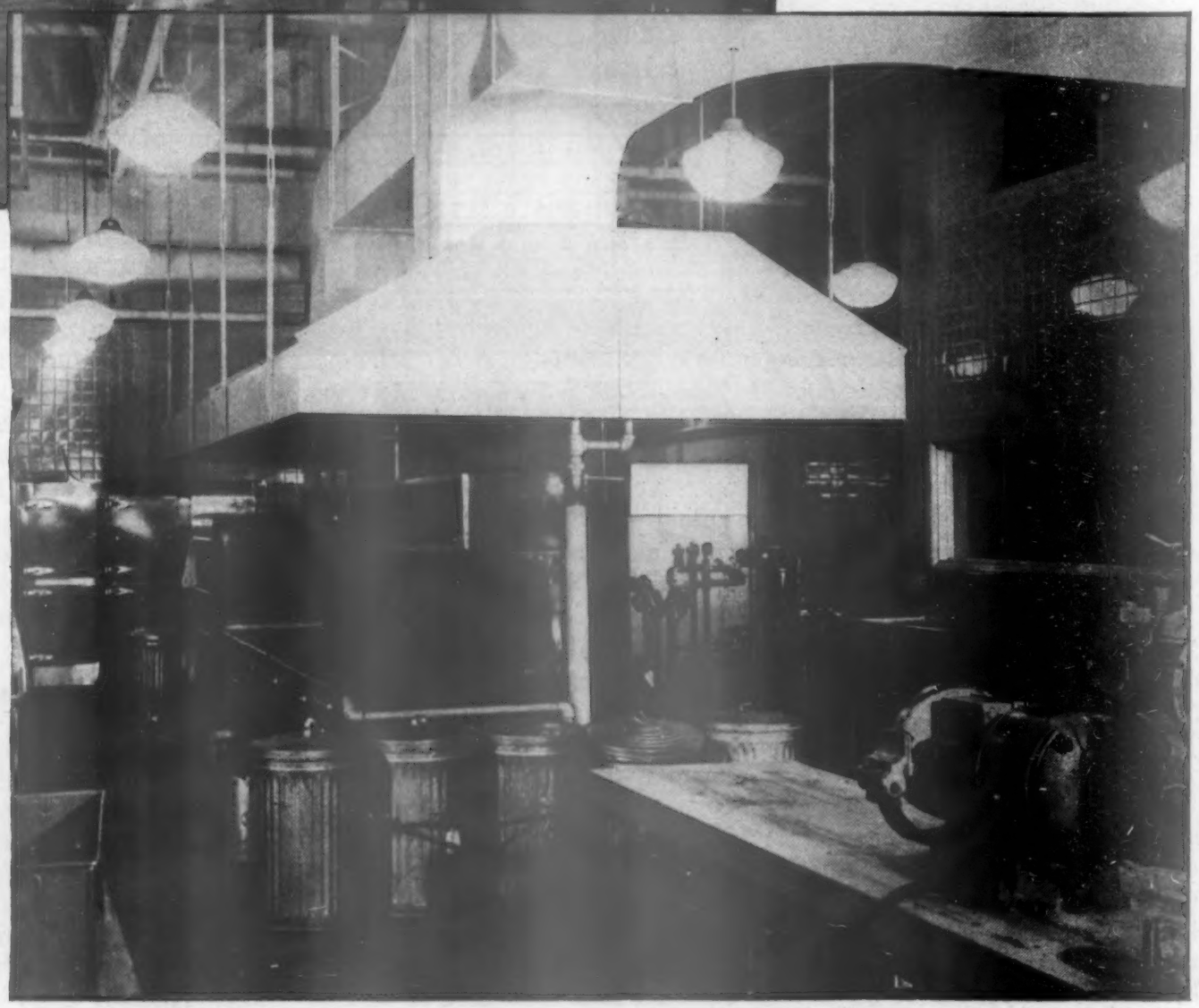
Offices on Street Front

General offices are located on the first and first mezzanine floors along the street front. The mezzanine is devoted to executive offices, while the first floor is occupied by the plant protection and employment departments. The employment department has a private side entrance from the street. All offices have acoustical tile ceilings, asphalt tile flooring, fluorescent lighting, fin tube type wall radiation, and sectional wood and glass office partitions. Controlled filtered air is delivered to the office area by concealed ducts.

The second floor houses the factory offices and production control laboratory, as well as the employees' cafeteria and the executive dining room. A fan room adjacent to the cafeteria contains all the air con-



Three service lines keep things moving in the air conditioned, sound-equipped cafeteria. Seating capacity for meals is 600, larger when it is used for employee entertainments and meetings



The well-lighted kitchen is fully air conditioned. It was designed for rapid service, and to be easy to keep clean

ditioning equipment for the first and second floors.

The cafeteria, which has seating space for 600 people, has tan and maroon terra cotta wainscot and columns, plastered walls, suspended acoustical tile ceiling, flush type fluorescent lighting, and an asphalt tile floor. The kitchen also serves the oak-paneled private dining room, and has been provided with the latest equipment for the rapid and sanitary preparation of food. Three serving lines insure quick service in the cafeteria. The entire eating area is fully air conditioned.

Sound equipment in the cafeteria makes it possible to broadcast news or music during the lunch hours, and the public address system attachments make the room an ideal place for employee meetings.

Regular lunch hour service is supplemented by mobile canteens which carry food from the cafeteria to the various plant areas during the day.

BUILDING MATERIALS AVAILABILITY AND PRICES

Building materials will be more plentiful in 1947 than during last year. Supply will match demand more closely than has been the case for some time.

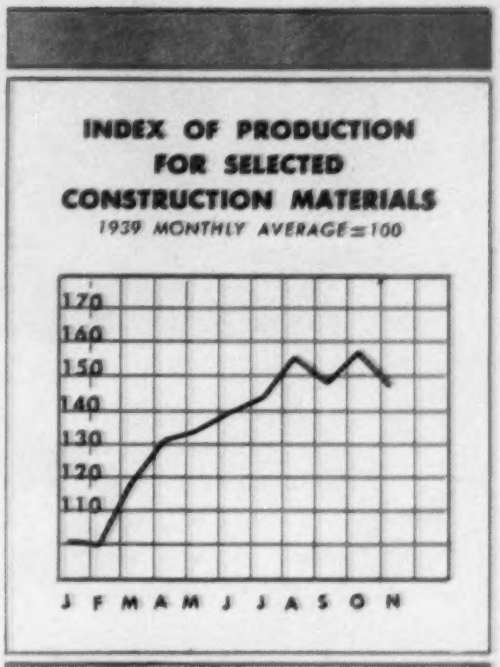
Prices of most building materials are still showing a tendency to advance slightly, but the chances are that from now on price rises will be comparatively slight, and a relatively stable plateau will be established. It is possible that some weaknesses may develop in the prices of certain items, or at least the spread between asking and selling prices will be widened.

Any attempt to forecast building materials supply and cost trends must be based on the assumption that no seriously abnormal conditions will develop anywhere along the line. Prolonged work stoppages or radical increases in wage rates in the building materials industries will inevitably tend to boost prices above the levels that now seem likely to prevail this year. A sharp recession in business activity, on the other hand, might result in definite price weaknesses.

Controls Relaxed

Easing of the material situation does not necessarily mean that any desired industrial building project can be put through without further delay. Government controls covering non-residential construction are still in effect, although there has been some relaxation.

The increasing availability of certain structural materials is well shown by a series of surveys conducted by *Engineering News-Record*. Spot checks of the availability of these materials were measured against local demand in twelve key cities: Atlanta, Ga.; Austin, Tex.; Boston, Mass; Buffalo, N. Y.; Chicago, Ill.; Cleveland, Ohio; Jackson, Miss.; Kansas City, Mo.; Minneapolis, Minn.; New York, N. Y.; St. Louis, Mo.; San Francisco, Calif.



Materials covered in these surveys are common and face brick, hollow partition tile, bearing tile, plate glass, concrete block, lumber 1½ inches and under, lumber 2 inches and over, heavy timbers, five-ply waterproof plywood, three-ply plywood, structural steel, steel reinforcing bars, and cement.

From the latest surveys it appears that builders in more than 50 per cent of the cities can now obtain adequate supplies of construction materials. Furthermore, if present rates of production and distribution are maintained, it is to be expected that by spring almost all builders in more than 75 per cent of our cities will find ample material for work that is under way.

Government reports show that new records were hung up last year for the production of many building materials. The Department of Commerce reports that its composite record of production of sixteen selected construction materials rose from 83.8 in December, 1945, to 159.5 in October, 1946, taking monthly production of these sixteen materials in 1939 as 100.

Last year, production of lumber rose from less than 2,000,000,000 board feet per month to almost 3,500,000,000 board feet. Production of soft-wood plywood, however, has remained nearly constant, at about 100,000,000 square feet per month.

Brick production soared to 528,000,000 in October, 1946, representing a 28 per cent increase over the average monthly output in 1941, the record year. In this same month the output of tile was 133,000 tons, which is nearly equal to the average monthly production in 1939.

Increases in the production of some other materials are as follows: Gypsum board and lath from 200,000,000 square feet per month in February, 1946, to 326,000,000 square feet in October; asphalt roofing from 5,000,000 squares per month to 7,000,000 squares; clay sewer pipe from 50,000 tons per month to 112,000 tons; cast-iron soil pipe from 27,000 tons per month to 47,000 tons; wire nails from 25,000 tons per month to 71,000 tons.

Steel Shipments

In November, 1946, shipments of fabricated structural steel amounted to 144,488 tons, as compared with a monthly average of 122,087 tons for eleven months in the years 1936-46. Shipments in December, 1946, were 142,071 tons. For the twelve months of 1946, shipments were 1,551,607 tons, which represents a 95 per cent increase over the 797,441 tons shipped in 1945.

Production of portland cement likewise has been stepped up. In November, 1946, 15,335 barrels were produced, which was 43 per cent increase over the corresponding month in 1945, and a decrease of only 6 per cent from the output in November, 1942, the peak production year.

From the standpoint of ready

availability of these and other materials whenever and wherever wanted, these high production rates are offset to some extent by the fact that stocks of many items are low. Huge quantities of materials will be required to build inventories up to normal levels. Maldistribution of materials has been a factor in the creation of local shortages, and conceivably may continue to exert an influence for a while.

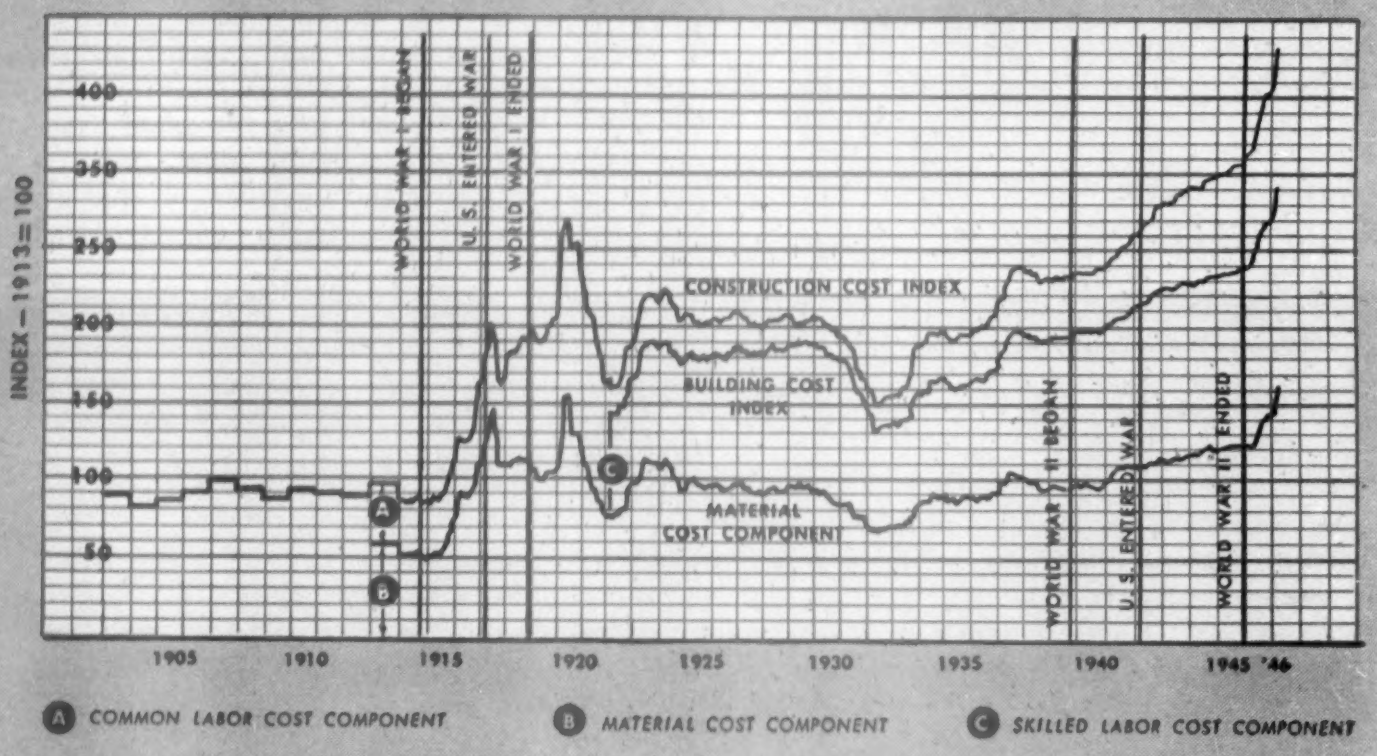
It is common knowledge that prices of construction materials have gone up all along the line. In some instances the rise has been very sharp. Bureau of Labor Statistics indexes, for example, show that in December, 1946, the wholesale prices of all construction materials reached 174.4, taking 1939 prices as 100.

In March, 1947, the trend of prices was still upward, excepting structural steel and clay tile. How long this trend will continue, and where it will ultimately bring prices, is problematical. Buyer resistance to further increases—some instances have appeared at present levels—and definite easing of the supply situation presumably will tend to keep price rises within comparatively narrow limits.

Any marked recession in prices, on the other hand, does not seem likely to take place. Heavy demand, higher wage rates, and higher cost of raw materials entering into construction materials would seem to preclude anything more than minor adjustment downward, under what may be considered to be normal economic conditions.

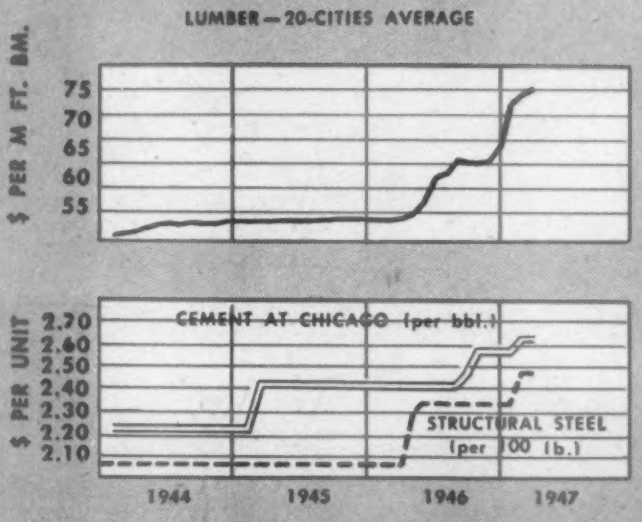
Engineering News-Record

CONSTRUCTION AND BUILDING COST INDEX TRENDS



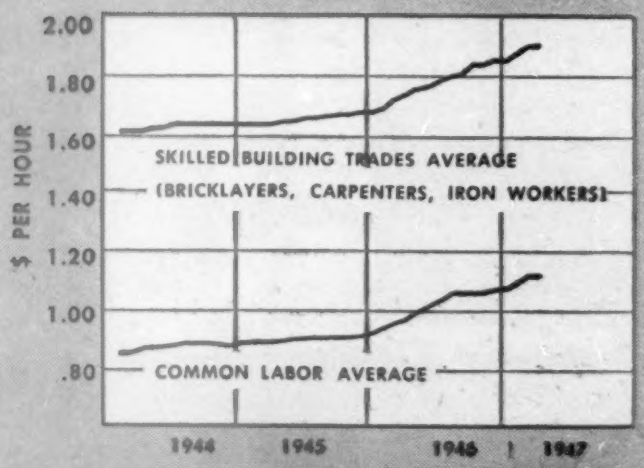
BUILDING MATERIAL COST PRICES

LUMBER — 20-CITIES AVERAGE



BUILDING CONSTRUCTION WAGES

20-CITIES AVERAGE



CHENEY BROTHERS

NEW PLANT AT MANCHESTER, CONN.

Need for modernization and expansion dictated the building of Cheney Brothers' new plant at Manchester, Conn. First unit to be completed in a $2,000,000 program, it was designed around the latest type of machinery and equipment required in the printing and finishing of fabrics.

Functionally designed, the building contains 70,000 square feet of floor space, is one story in height, with brick and steel-sash walls. Framing in the basement is reinforced concrete; above the basement level it is structural steel. Clearance from floor to lowest truss chord is 16 feet, allowing ample room for the relatively large process machinery required. Based upon

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CLEVELAND

this consideration, column spacing on the first floor is 51x60 feet. Added support for machine weight is provided by closer spacing of the cellar columns, 17x20 feet.

In the interests of flexibility, all inside distribution lines are run overhead, with ample clearance provided by the roof height of 20 feet, 2 inches. The roof itself is of 2-in. concrete plank, with 2-in. cork insulation and a smooth composition roofing. Daylight in the plant is provided by continuous monitors on the roof with fixed steel sash. Because of the large amounts of steam present in the plant in the winter, special inside gutters have been provided for condensation, and provisions made for converting for double sash if this later seems advisable.

The heating system is fed from an existing central power house which also furnishes heat to the other parts of the plant. Steam and hot air are used for space heating, delivery being accomplished through unit heaters and finned pipes. Process steam is likewise brought into the plant from the central power house.

The remainder of the various

General illumination is maintained at 25 foot-candles. Supplementary lighting is provided, by fluorescents if possible, where needed

Special outlets on ventilating system prevent drafts in the plant. Continuous monitors provide the high light. All service lines carried overhead for maximum flexibility

NEW PLANTS OF 1946

High-ceilinged, 70,000-sq.-ft. building admits plenty of natural light, is connected by covered passageways with older units

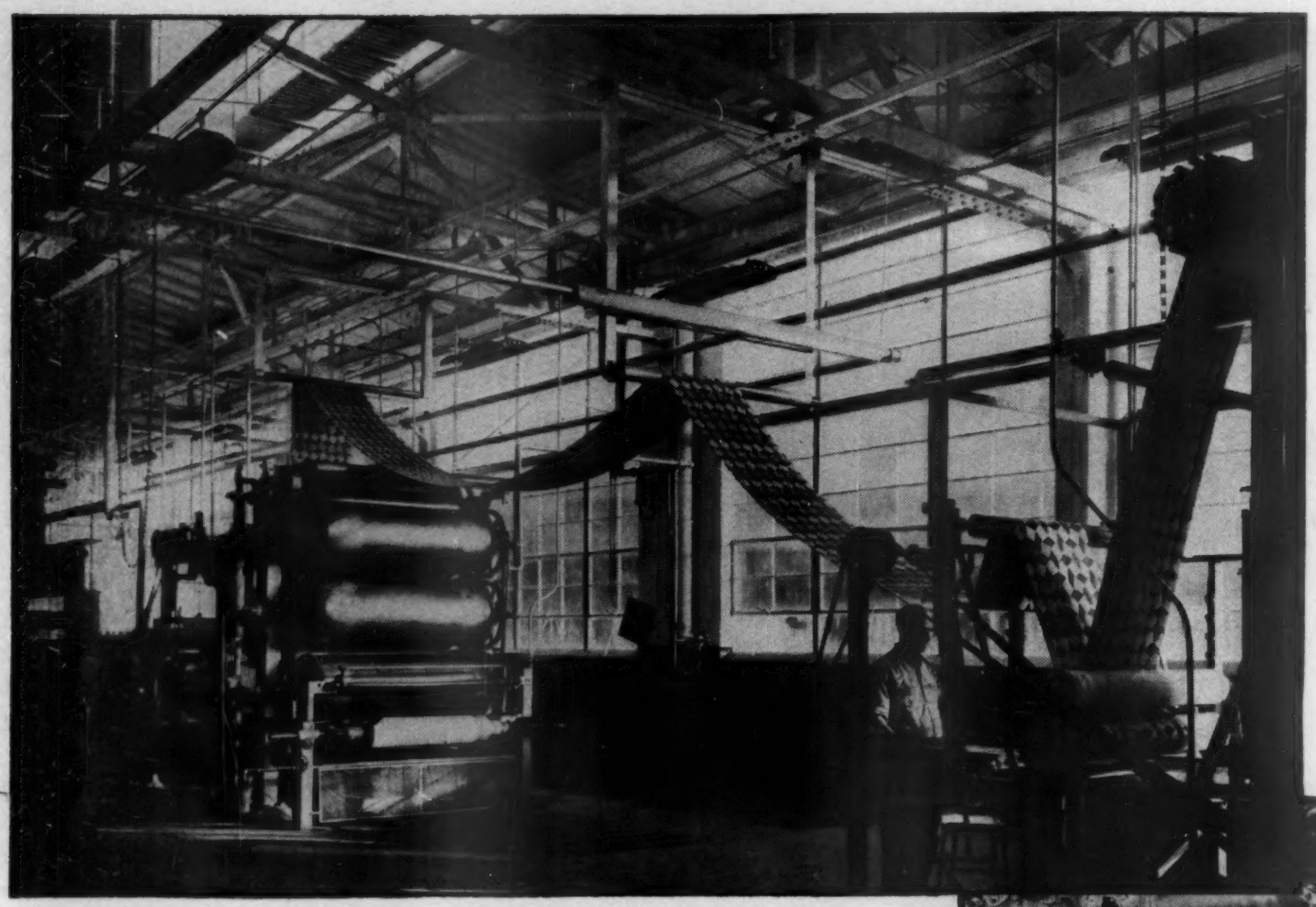
Located on a 2.8-acre plot, this building is the first step in Cheney Brothers' $2,000,000 expansion program at Manchester, Conn.

building services, including the ventilating equipment, are located in the 12,300-sq.-ft. basement. The capacity of the ventilating system is rated at 100,000 c.f.m., and the distributing ducts are equipped with specially designed outlets at all points. The distributing ducts are partially underground and partially overhead, the arrangement having been planned to minimize the distance from the basement equipment to the outlet point, and at the same time eliminate all obstructions in the working areas. Power-driven roof ventilators are used as exhausts.

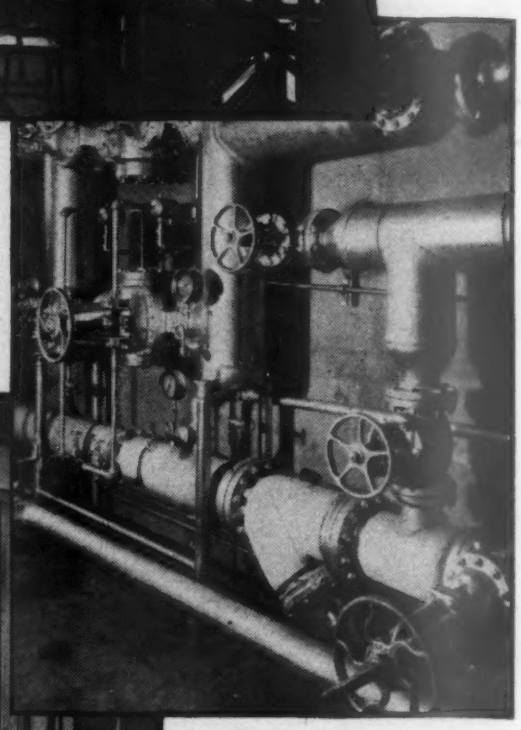
Basement Storage Space

The basement also provides storage space for the various copper engraved plates used in printing the fabrics, as well as for a first aid room, lockers, and washrooms.

Lighting throughout the operational areas of the plant is maintained at the 25-foot-candle level through the use of banks of RLM



Minimum clearance of 16 feet to truss chords, with column spacing of 51x60 feet, provides ample space for the large, and often high, pieces of machinery



All service lines enter building underground from central power house, are redistributed from the control room in the basement

fluorescent fixtures. Additional illumination is provided wherever required by the process or the nature of the machinery being handled. Use is made of incandescent bulbs in the basement, with RLM reflectors, to provide about 20 foot-candles. Natural light is used to supplement artificial when possible, in addition to the monitors, the largest possible wall area has been devoted to windows. Steel sash with pivoted ventilators has been used throughout.

Combination wood-and-glass partitions in the plant also help to bring natural light to areas remote from the sidewalls. The sidewalls of the building are concrete up to the first-floor level, and 12-in. brick above, with precast concrete coping.

Adjoining the receiving bay is a covered platform for incoming and outgoing truck shipments. To facilitate the sometimes heavy handling in the plant, there is a basement-to-first-floor hydraulic-type elevator. The car is approximately 5x7 feet, with a maximum capacity of 2½ tons. The floors throughout are concrete slab in which a metallic hardener has been used.

Provision has been made for mechanical handling wherever possible

Located on a 2.8-acre lot, the new structure has become an integral part of the existing network of buildings. Covered passageways have been utilized to connect it with the older units.

GENERAL MOTORS CORPORATION

NEW PLANT FOR TRUCK & COACH DIVISION AT PONTIAC, MICH.

ARCHITECT
●
ALBERT KAHN ASSOCIATED ARCHITECTS & ENGINEERS, Inc.
DETROIT

To permit the utilization of mass assembly methods similar to those used by the wartime aircraft industry, the Truck & Coach Division of General Motors has undertaken a seven building, 2,000,000 square foot, expansion program. First unit completed in this move to double present facilities is the 400,000-sq.-ft. assembly building.

Other structures will include an engine building, engineering building, dynamometer building, two warehouses, and service stations. All will be strategically placed to make the fullest possible use of existing power, administration, hospital, and other central facilities at the Pontiac, Mich., plant.

Ultimately, all major operations will be housed in an integrated layout conveniently arranged for quick intercommunication and materials handling.

Emphasis on Welfare

Employee facilities are receiving unusual emphasis in the over-all plan. Parking areas are being redesigned for quick and easy access to the plant, men's and women's showers are being provided, new toilet arrangements and handling of internal traffic at shift-change times are designed into the physical property. An elaborate central kitchen complete with bake shop and large food storage facilities provide varied menus for the 60x80-ft. cafeteria. Lunch counters and snack bars also are provided.

The new assembly building is constructed on a steel frame with brick facing and steel sash. The structure is one-story, 720x540 feet in plan, with 16-ft. clearance to the lowest chord of the roof trusses. An abundance of natural daylight in the assembly areas is provided by nine monitor lines which run the full length of the metal deck, insulated roof. The column bays are uniformly 40x60 feet. The floor is concrete, with special reinforcing adjacent to the depressed railway trackage into the receiving area where heavy sheet steel is unloaded; also flanking the railway dock is an export packing plant. Cranebays over this area provide 20-ton lifts.

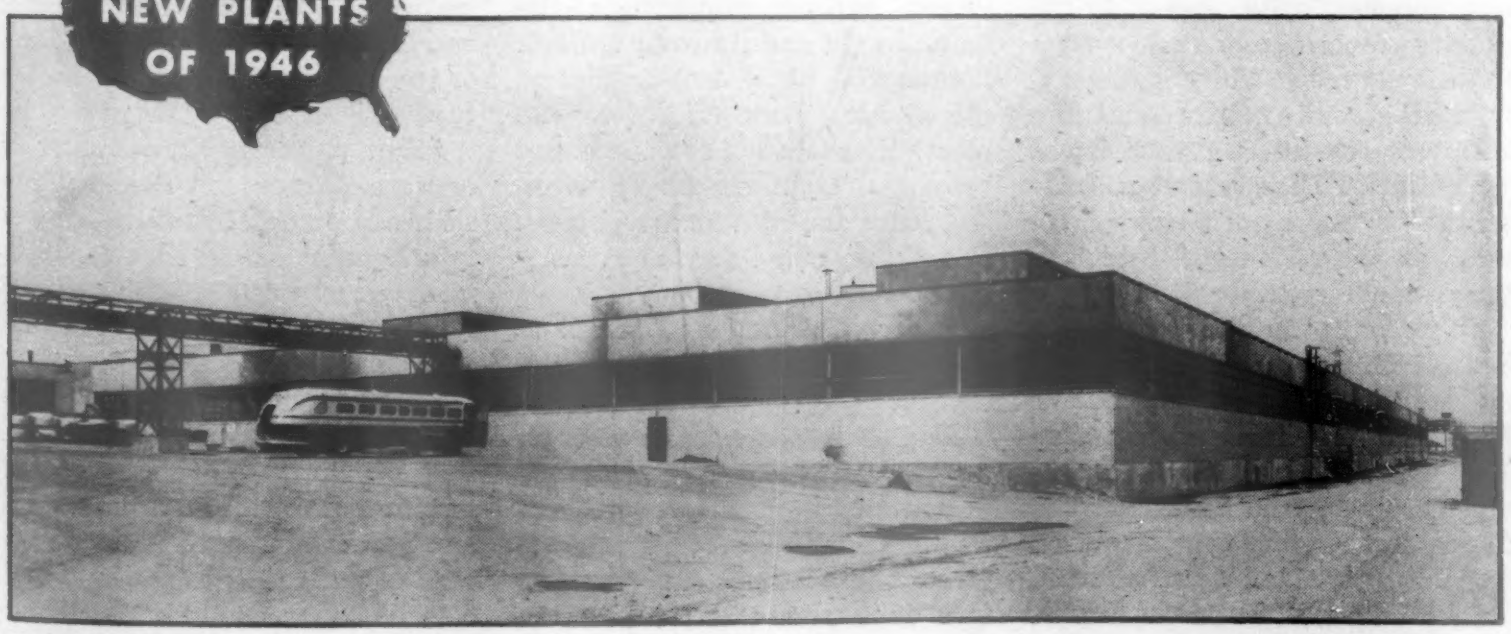
Truck wells at the north end are used mainly for incoming materials, and a drive-away lot and test track are entered from the northeast corner of the plant near the end of the process flow line and final inspection post.

Several miles of overhead pilot type conveyors service the numerous jig-and-fixture stations, bonderizing, enclosed spray booths, sanding decks, water test, and paint mixing areas.

Heating services, plumbing lines, and other service lines brought to the building were designed to be large enough to supply all the buildings in the expansion plan.

Production areas are heated by means of unit heaters suspended overhead in the trusses. Instead of the vertical projection type heaters in general use in the plant, those near the doors are of the inverted blower type, with extended outlets. Besides the normal three-position starters and thermostats, the door heaters have automatic switches which start the heater whenever

One-story, 400,000-sq.-ft. assembly building is the first step in a seven-unit expansion program at Pontiac, Mich.



the door is opened, regardless of the thermostat setting. The office and locker room sections are heated by high pressure radiators.

The blower units and radiators are supplied with steam at 30 pounds pressure from a grid system in the truss space. The grid, in turn, is supplied from a high pressure line with reducing valves at each end of the building. The condensate is discharged by means of a return system into the feed water heater in the power house.

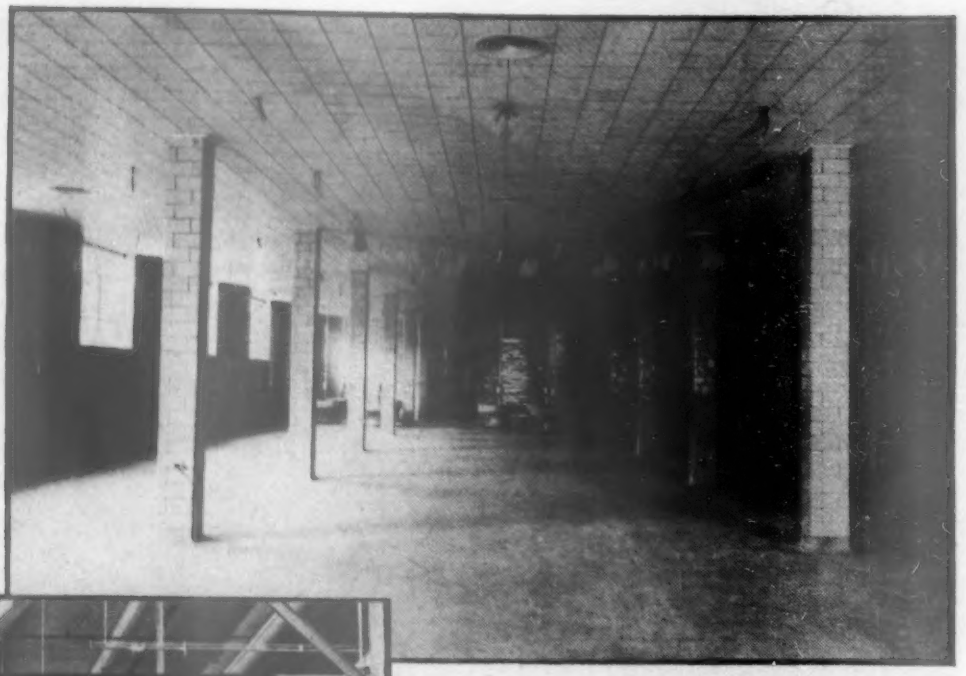
To make up for the process exhaust from spray booths and other manufacturing operations, four large fan units in separate rooms introduce fresh air in to the building. Complete with intake louvers, filters, and heating coils, each fan unit handles 85,000 c.f.m. of fresh air from 10-deg. F. to 80-deg. F. Air temperature is controlled by a duct stat which maintains a constant supply temperature of approximately 75 deg. F.

Industrial type, open end, fluorescent fixtures supplement the natural light and insure a uniform illumination of 30 foot-candles at the working plane throughout the plant. The fixtures are suspended by chains from messenger wires, and connected with cords and plugs so that they may be removed easily for cleaning or servicing.

Power distribution throughout the plant is accomplished by metal enclosed, plug-in type buses. Nonmetallic sheathed cable is used for connections between the bus and the actual production equipment. Two 4800-volt lines from the central power house furnish energy to two unit type substations located in switch rooms on the roof. From these points, distribution is at 440 volts, three phase. The substation buses are connected in pairs through interlocked circuit breakers which will not permit parallel operation of the substations. Line or transformer failure will not disrupt service except for the time required to perform switching operations. Power for the lighting system is provided through column type lighting panels, each of which is served by a 440/120/240-volt dry type transformer located in the truss space.

Ceilings and walls inside the plant are painted industrial white, as is the sash. Dadoes, doors, and other inside trim are gray. Trim, windows, and doors are painted green on the outside, and the brick is a light buff color.

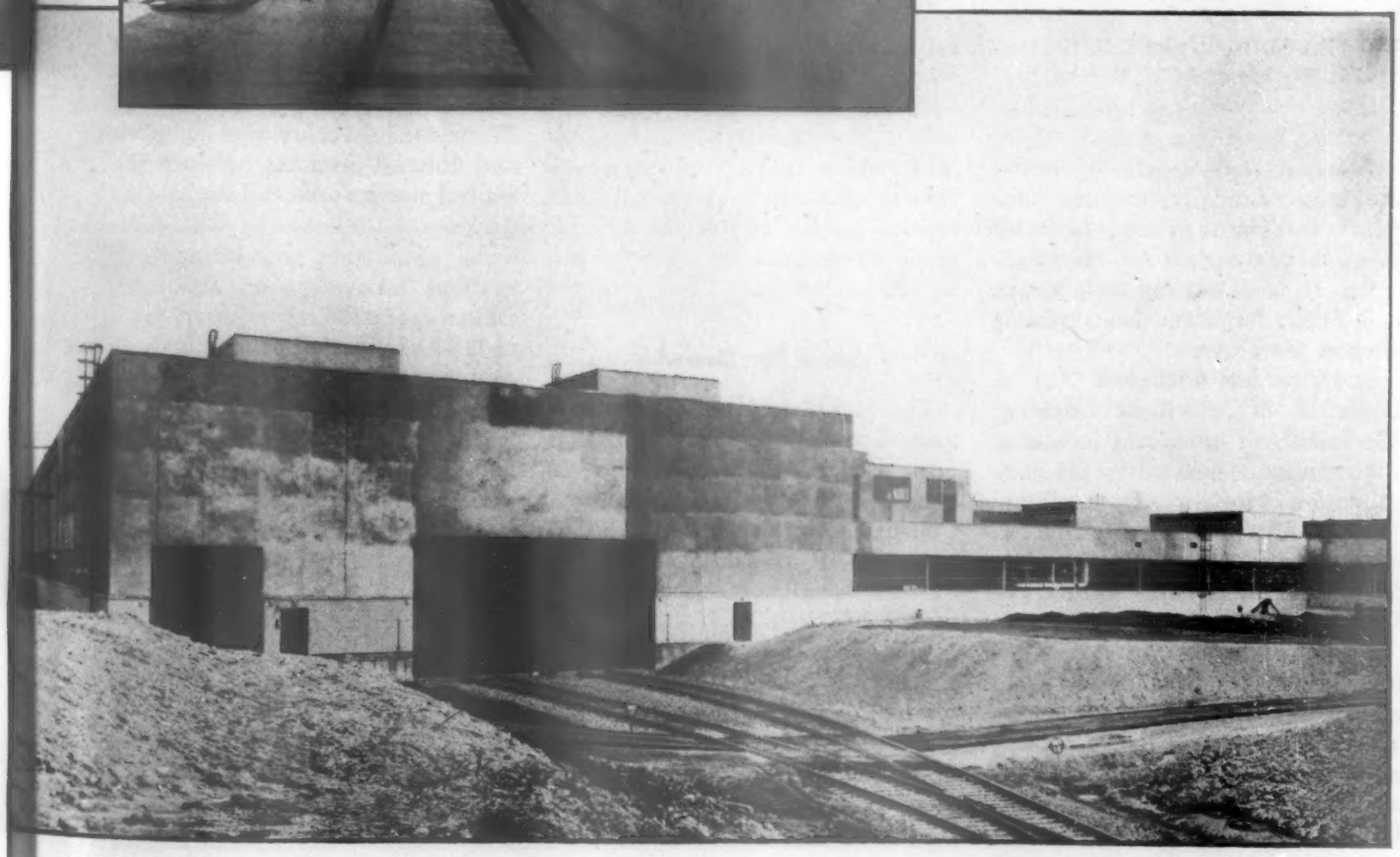
Depressed railway tracks in the receiving dock simplify unloading of heavy sheet steel. The crane bays provide a 20-ton lift. Concrete flanking the tracks is specially reinforced for heavy loads

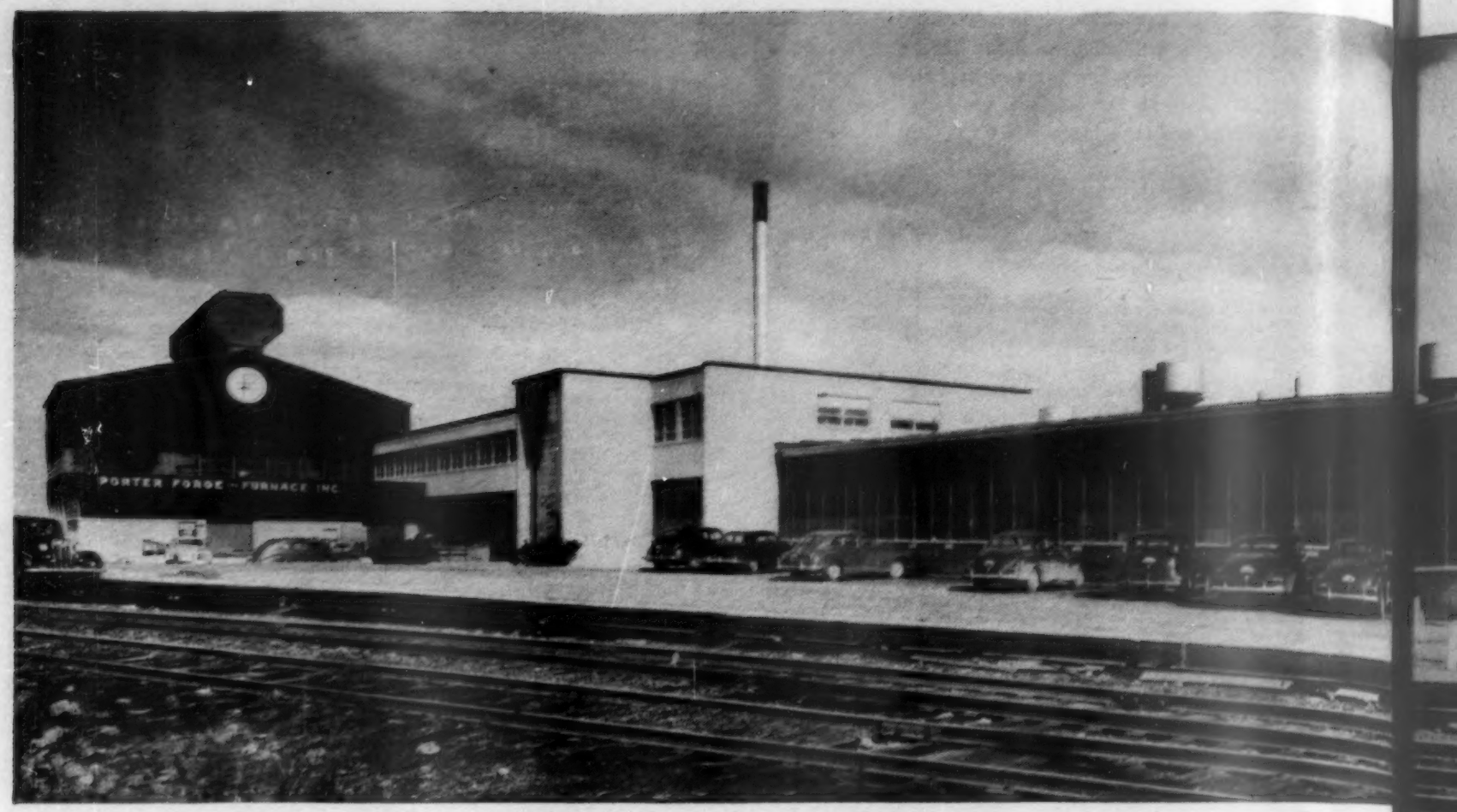


With column bays a broad 40x60 feet, coach bodies will move through this assembly area in a manner paralleling mass-production in the aircraft industry

Cafeteria and locker areas, walls of glazed tile, ceilings of acoustical tile—because they are easy to keep clean. Hot food is brought in from a central kitchen that will serve all buildings in the new unit

Covered truck unloading platform (below, far left) parallels rail spur into receiving dock. Continuous monitors assure good supply of natural daylight





H. K. PORTER, INC.

NEW PLANT AT SOMERVILLE, MASS.

With its new plant at Somerville, Mass., H. K. Porter, Inc., aims to overcome the inefficiencies resulting from operation in three antiquated and widely separated buildings. Actually, the new factory is two plants in one—a general manufacturing plant for the fabrication of hand cutting tools at one end, and a forge and heat-treating shop at the other.

Specifications included: (1) A minimum of interplant trucking; (2) minimum intraplant handling; (3) maximum flexibility; (4) consolidation of functions for minimum "overhead" personnel; (5) free expansion possibillties; and (6) minimum cost of possible future rearrangement.

Products are too varied to allow for efficient straight-line flow from raw materials receiving to shipping. The production flow, therefore, was planned to loop around a central receiving, shipping, and storage area. In this layout, all flow of material originates and ends in a central receiving and shipping yard, which is bordered by a loading dock for trucks, connected to a loading ramp for freight cars. This reduces travel time to a minimum, and permits the central section of the plant to be fixed indefinitely as an area reserved for storage.

Room for Growth

The floor plan also allows the tool manufacturing plant to grow in two directions and the forge shop to expand considerably in one direction. Construction allows for dismantling exterior walls and their re-erection in new locations without loss of materials.

The plant is built around two sides of the receiving and shipping yard, which is big enough for the biggest of trucks to turn around in. The loading dock, flanking the yard on two sides, is protected from rain, the covering being in its major part the overhang of the second-story offices. There are no columns to interfere with loading and unloading. Electric trucks carry raw materials and finished products between the central storage area and the loading docks.

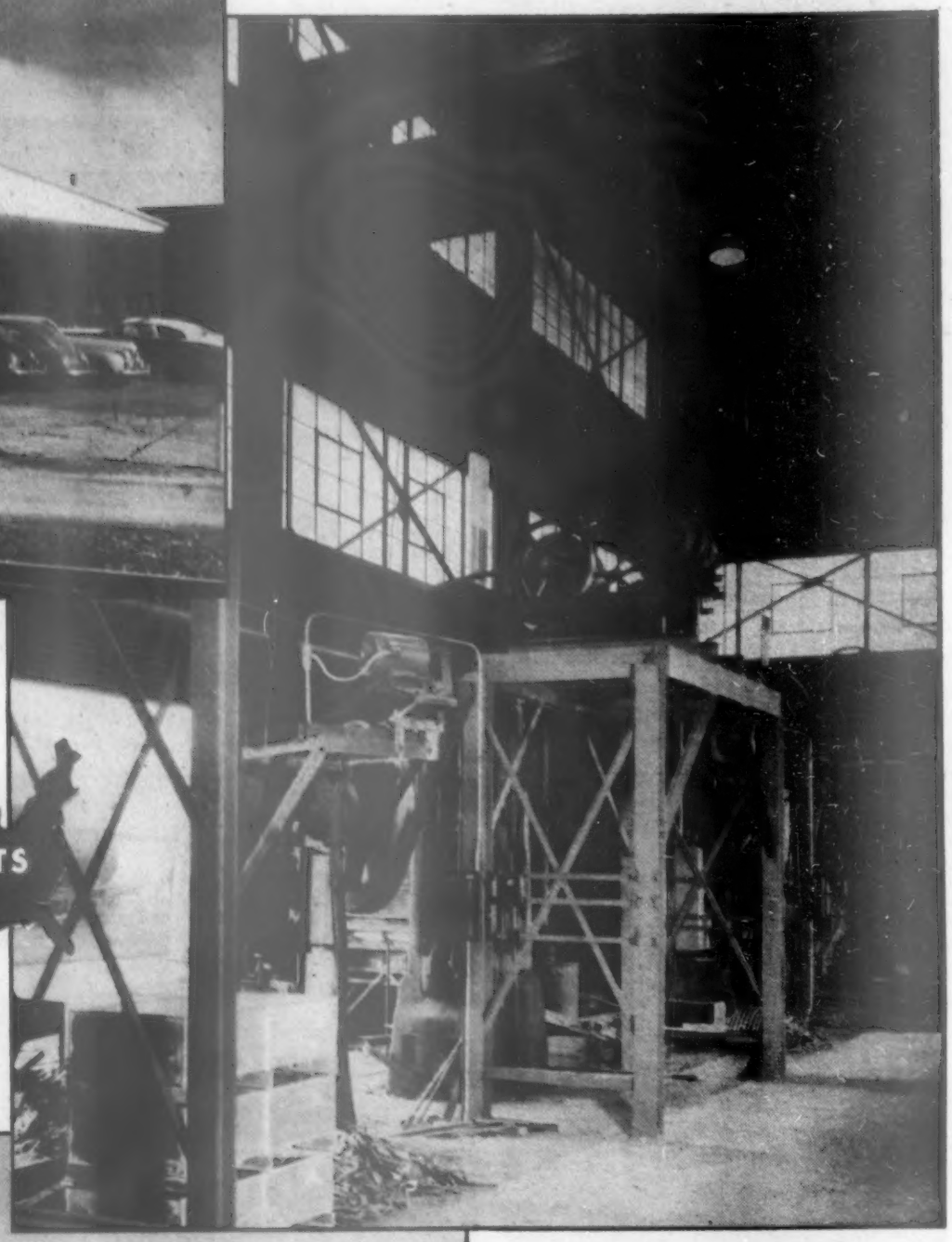
All production and storage operations take place on one floor. Offices are on the second floor. Most of them are located beneath a mezzanine on which some locker-rooms and workrooms are located. Finished - goods storage areas are fenced off, and centralized storage permits a minimum of personnel for handling.

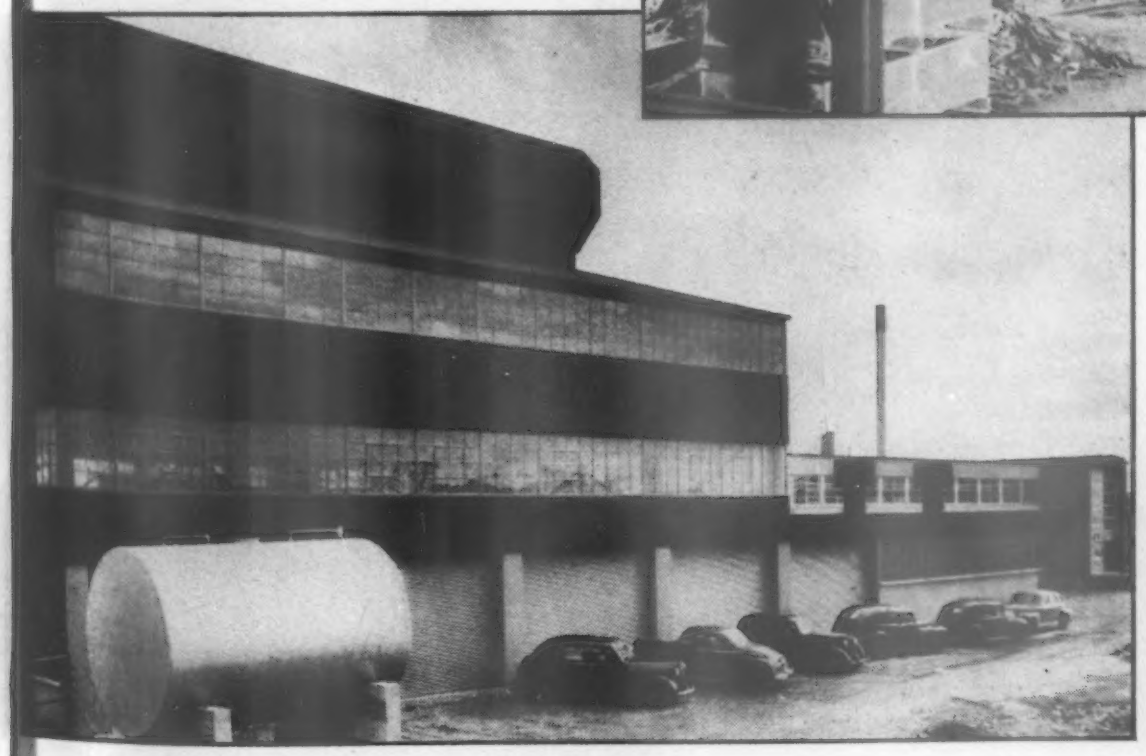
Offices are easily accessible to

ARCHITECT
●
WALTER F. BOGNER
CAMBRIDGE, MASS.

New Porter plant is located immediately adjacent to good rail transportation. Forge shop is at far left. Tool manufacturing area is at right. Offices and employee facilities (center) serve both

NEW PLANTS OF 1946





Roll-up doors on three sides of the forge shop permit the building to be opened up wide on warm summer days. Sides of the structure practically disappear. No furnace heat gets trapped here

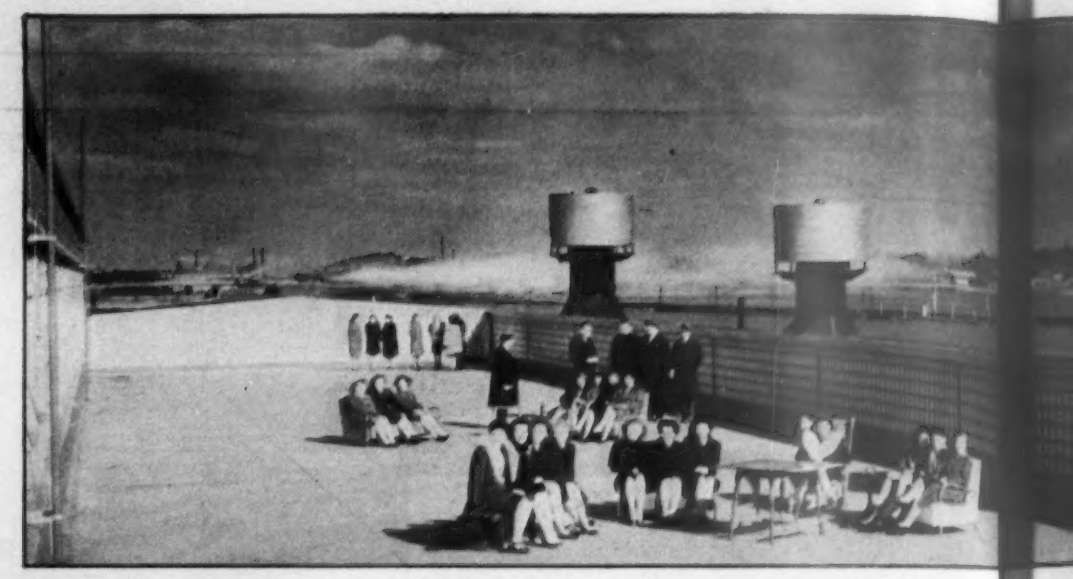
Forge shop has broad roll-up doors, gets plenty of high light through two bands of windows, and is topped by a heat valve designed to carry off gases

both parts of the plant. A central cafeteria, showers, locker-rooms, and a medical clinic serve workers in both sections. A 40x200-ft. recreation deck for the use of all employees is reached through the cafeteria. Most of the offices adjoin this sun deck and hence enjoy an abundance of daylight.

The entire plant was designed for optimum use of natural lighting and ventilation. Full-height windows with heat-absorbing, glare-reducing glass are installed from floor to eye level. A strip between the 4- and 6-ft. levels is of clear glass for view windows. Motor-operated ventilators in the roof are an aid to comfort in hot weather.

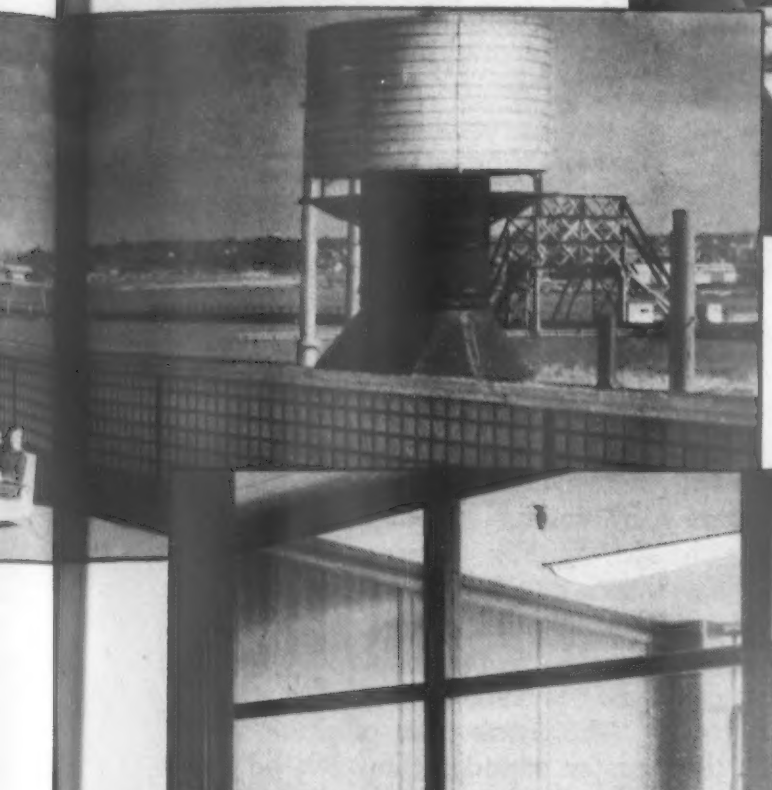
The main building is of steel-frame construction, using standard rolled sections in its major portions. Column bays are 20x40 feet. Only in the forge shop were steel trusses resorted to; there they permit a rolling bridge crane of 40-ft. span. Sidewalls are 4 feet high, built of 9-in.-thick cavity-construction brick, with a continuous band of steel sash 10 feet high above them.

Construction of the forge shop provides a maximum of natural ventilation. This section of the building can be opened around its entire periphery by rolling doors, 12 feet high, to admit fresh air and sunlight. The roof is high and is capped by a 7-ft.-wide heat valve to carry off hot gases. Operations can be carried on in summer with the same comfort as though they were performed outdoors. This shop,



A corner of the manufacturing area bordering on the storage rooms. All service lines are overhead to allow maximum flexibility. Banks of fluorescent lamps provide uniform, high-level illumination throughout

Recreation sun deck was opened after the weather began to chill last fall. Fully equipped for lounging, it is expected to be a popular lunchtime "hang-out" during the hot summer months



Offices are large and airy; get plenty of natural light, supplemented by fluorescents; are cooled in summer by spraying water on the roof

Executive offices are air conditioned; have soundproofed ceilings, recessed lighting fixtures, glassed partitions, asphalt tile floors, and are heated by concealed convectors

which requires no space heating in winter, is enclosed by a corrugated, galvanized sheet material, coated with fiber and asbestos.

Utility lines are distributed from a central point. Low-pressure steam, 550-volt current, high-pressure air, and hot- and cold-water lines radiate from boilers, switchboard, and transformers clustered near the storage area.

Cool Offices

Executive offices are fully air conditioned, and the general offices may be cooled by spray nozzles on the roof. Steampipes supply downdraft unit heaters along the outside walls. The executive offices are heated by concealed convectors, while general offices, engineering rooms, and minor offices have concealed radiators built into the window breastings.

A workplace illumination of 30 foot-candles in the production areas and 40 foot-candles in the assembly area is obtained from fluorescent units, while a 15-foot-candle level is maintained in the storage rooms by incandescent lamps with prismatic glass reflectors. Office space is provided with 30 to 40 foot-candles by means of fluorescent fixtures, with recessed ceiling units in the executive offices.

WAREHOUSE DESIGN AND CONSTRUCTION

BRUCE HAINSWORTH
SPECIAL PROJECTS CONSULTANT, THE H. K. FERGUSON COMPANY
CLEVELAND

Few industrial concerns are in the habit of thinking of a warehouse as a highly complicated tool. Nor do they think of it as requiring much careful consideration and pre-planning.

Modern business often decrees, however, that a warehouse be much more than just a storehouse. For example, space must often be provided where large shipments of goods can be broken down into small units. If the number of commodities handled is large, breaking down the stock into individual orders involves a serious transportation problem within the warehouse. And the shipment of goods by both rail and truck necessitates two separate shipping docks.

In many cases, work must be performed on goods between the time they are received and the time they are shipped. Many types of goods are removed from the original cases or crates before reshipment; sometimes it is necessary to recrate them at the warehouse.

Actual design of any warehouse is a highly individual matter, and, in general, should take the following into consideration:

1. Types of goods handled.
2. Rate of turnover.
3. Number of warehousing operations to be performed.
4. How goods are received.
5. Types and size of orders handled, wholesale or retail.
6. How goods are shipped.

The first three items affect the size and design of the warehouse; the last three affect the size and design of the shipping and receiving areas. Based on these factors, a number of general determinants may be cited.

Light, bulky, or irregular-shaped merchandise increases the required area. Slow turnover decreases it, and *vice versa*. Truck shipments need larger shipping and receiving docks than do rail shipments. Space requirements increase rapidly with the number of operations to be performed. If merchandise is sold by individual items, and the stock covers a considerable field of types and kinds, transportation becomes the major factor around which the design must be built.

Package Handlers

Among the more common types of materials handling equipment generally considered for packaged goods are the following:

Belt conveyors, which are adapted for handling solid materials such as coal, gravel, or grain in bulk from fixed storage piles over long distances to bins or hoppers near the point of use.

Flat belts and live rollers, used to convey regular package goods and merchandise of many kinds.

Apron conveyors, a special adaptation of the continuous type of conveyor, consisting of a series of pans or platforms mounted on chains to form a continuous carrying surface.

Monorail chain conveyors, which use any standard form of four-wheel truck as the means of conveyance. These trucks are fastened to an endless, overhead moving chain that pulls the loaded trucks to any desired spot.

Moving floors usually are special types of apron conveyors which permit four-wheel trucks to be pushed on and off while in motion.

Monorail carriers for four-wheel trucks, working on the principle of a monorail tractor unit that furnishes power for a train of four-wheel trucks, also have been developed. Each train can be dispatched to any selected destination, and it will come to a stop at that point automatically.

The tractor-trailer train method of moving merchandise is a standard method of transportation applicable to almost any type of warehouse problem. Tractors are built in several sizes, can haul trains of various lengths and tonnages.

Special Problems

There are other special types of conveyors that may receive consideration for special handling problems. For instance, overhead monorails are useful for unloading and handling pipe, whereas fork trucks are invaluable in unloading and stacking merchandise.

The integration of these varied major considerations can be illustrated by a warehousing study recently completed for one of the large mail order houses. Preconceived ideas were dropped, and the result turned out to be a hollow, circular-shaped structure with receiving platforms on the outside rim and shipping platforms on the inside.

The warehouse had to be designed to handle a large volume of heavy goods, with a maximum amount of mechanical handling equipment to reduce costs. Also, it had to permit 100 per cent expansion of facilities at a reasonable expense. The preliminary study showed that the warehousing procedure comprised four major phases:

1. Receipt of merchandise.
2. Movement of similar items to the appropriate warehouse division for storage.
3. Movement of merchandise from warehouse divisions to the order assembly floor.

4. Assembly of merchandise in shipping lots, and distribution to the various truck loading stations for outshipment.

The goods handled cover a wide range of shapes, sizes, and weights. They are received from railroad cars or trucks, but are shipped mostly by truck. It was decided, however, that the design be such that all merchandise could be received and shipped wholly by either means.

Designed for Expansion

Exclusive of receiving and shipping areas, the warehouse proper had to contain about 500,000 square feet of storage space and lend itself to easy expansion to twice this size. Efficient handling of merchandise demanded the provision of additional facilities for examination of merchandise, control of stocks, preparation of material for shipment, filling of orders, and movement of goods in and out of stock areas.

It was determined that receipt and storage of merchandise would be greatly facilitated if each warehouse division were provided with its own unloading or receiving facilities. To meet this requirement, space for three railroad cars and three trucks was provided at the receiving end of each division.

For interior transportation, three four-wheel-truck systems were recommended for the following reasons:

1. Such systems are highly flexible because their capacities may be easily varied by the addition or subtraction of trucks. Also because the trucks do not operate on a fixed track.

2. Use of trucks makes it possible to extend the transportation system to exact points of loading and unloading, thus reducing the number of transfer points between receipt and shipment.

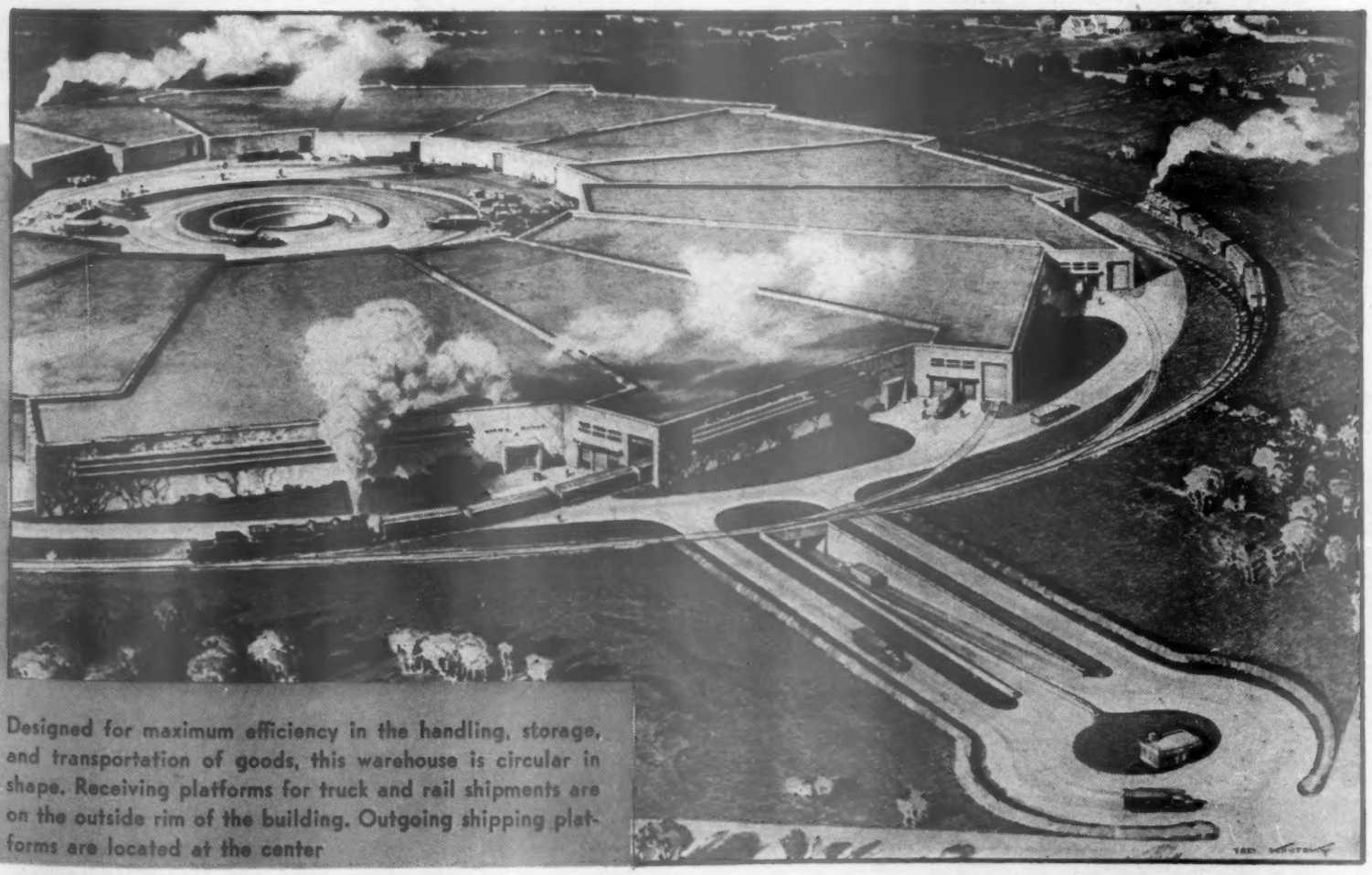
3. A mechanical breakdown in one phase of a truck system does not render the entire system inoperative—the trucks may be moved by standby tractors or manpower.

The four-wheel trucks, which became an integral part of the conveying system, are equipped with two swiveled wheels. Since the trucks are to be coupled into trains, each is equipped front and back with automatic coupling devices.

Three truck systems are used in the warehouse, usually in conjunction with one another. To move merchandise from receiving areas to stockpiles, up to eight loaded trucks are hooked to electric tractors. Orders are filled from stockpiles by loading trucks and hooking them to one of the overhead chains that make complete circuits around the firewalls that separate the warehouse divisions. Trucks are then conveyed unattended to the edge of the order assembly floor, and disconnected automatically.

Moving Floor

Here they are collected and distributed to the truck loading stations by tractors that make continuous circuits around the order assembly floor. In the type of building finally recommended, it was possible to introduce a highly efficient moving floor to replace the tractors on the order assembly floor. Eight feet wide and moving at a rate of 48 feet per minute, this merry-go-round device carries loaded trucks from chain conveyors to truck loading stations and returns empty trucks to warehouse divisions.



Designed for maximum efficiency in the handling, storage, and transportation of goods, this warehouse is circular in shape. Receiving platforms for truck and rail shipments are on the outside rim of the building. Outgoing shipping platforms are located at the center

PLANNED UPKEEP PAYS OFF AS NEVER BEFORE

This year the building maintenance program will be a top management problem in many a plant.

Not only will management face the ever-demanding problems of inspection and preventive maintenance, it will also have to devote particular attention to cost factors.

With both labor and materials scarce, preventive maintenance and rebuilding to save new construction will pay off as they seldom have before.

Coming due, too, will be special problems born of the necessities of war. Twenty-gage sheet steel flashing used in place of copper will be rusting out. Concrete loading platforms built without reinforcing and without angle-iron curbing may begin to break up rapidly. All the other improvisations of non-critical "four-year" materials for the old reliables will need attention, may need repair or replacement.

Shortages are still complicating the problem. Steel, copper, wiring devices, plumbing—a long list of materials and equipment may be hard to find as industry and the country go into a construction season expected to be one of the greatest ever. Maintenance departments, too, are still feeling the effects of wartime manpower shortages, still face the problem of breaking in new inspectors, engineers, and workers.

BUILDING MAINTENANCE IS IMPORTANT

■ WHY

With both labor and materials scarce, preventive maintenance and rebuilding to preserve existing plant and defer new construction will pay off as never before.

■ HOW

Systematic inspection and prompt repair can cut maintenance costs to a fraction of the bills for unplanned, sporadic "repair when you must" maintenance.

■ WHO IS TO INSPECT

Needed repairs and maintenance can be determined by a competent inspector making a thorough inspection of all parts of all buildings. If no qualified plant man is available, it will pay to call in one or more outside specialists.

■ WHAT TO LOOK FOR

Minor deterioration or comparatively unnoticed flaws in any plant building construction may mean serious damage and major repairs later on if not promptly repaired. Details of what symptoms to look for under each of these items are reviewed in this article.

■ HOW TO GET RESULTS

Use of check-lists by the inspector insures that no items subject to wear, neglect, or damage will be overlooked in his examination. These lists also provide a final written report of the nature of defects found. They can serve, too, as a guide either for reinspection after repairs are made, or for a special precautionary interim inspection of incipient trouble spots.

Cut Repair Costs

Systematic inspection, catching cracks in surfaces and joints before weather can erode them into major troubles for the maintenance gang, can cut maintenance cost to a fraction of the bills for unplanned, sporadic "repair when you must" maintenance.

A thorough inspection now, especially if some maintenance has been deferred because of wartime and post-war difficulties, is a "must." If your plant does not have its own inspector, who in smaller plants may be chief of the maintenance gang, bring in a maintenance engineer or an architect to survey interiors and exteriors, report conditions which need attention now, and note incipient troubles which should be re-examined later.

Foundation Walls

Check foundation walls for signs of failure or weakness. Inspect joints between walls and floor, between sections of the walls, or between parts of buildings, for cracks and leaks. Water leaking through a hair crack may heave walls through frost action, or may erode walls and the soil or foundation beneath them. If cracks are caused by movement through expansion and contraction, seal them with an elastic calking compound. Sealing with a rigid material may cause additional cracking. However, subgrade walls may be sealed with rigid materials, since they are usually not subject to extreme temperature changes.

Walls should be dry and not pitted. Dampness can usually be cured by sealing walls with waterproofing

CONTINUED ON PAGE B-74

SMART MAINTENANCE MEN

save time and money with these

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Pennsalt PM-90 and PM-95... acid-type products for cleaning and descaling boilers and condensers.

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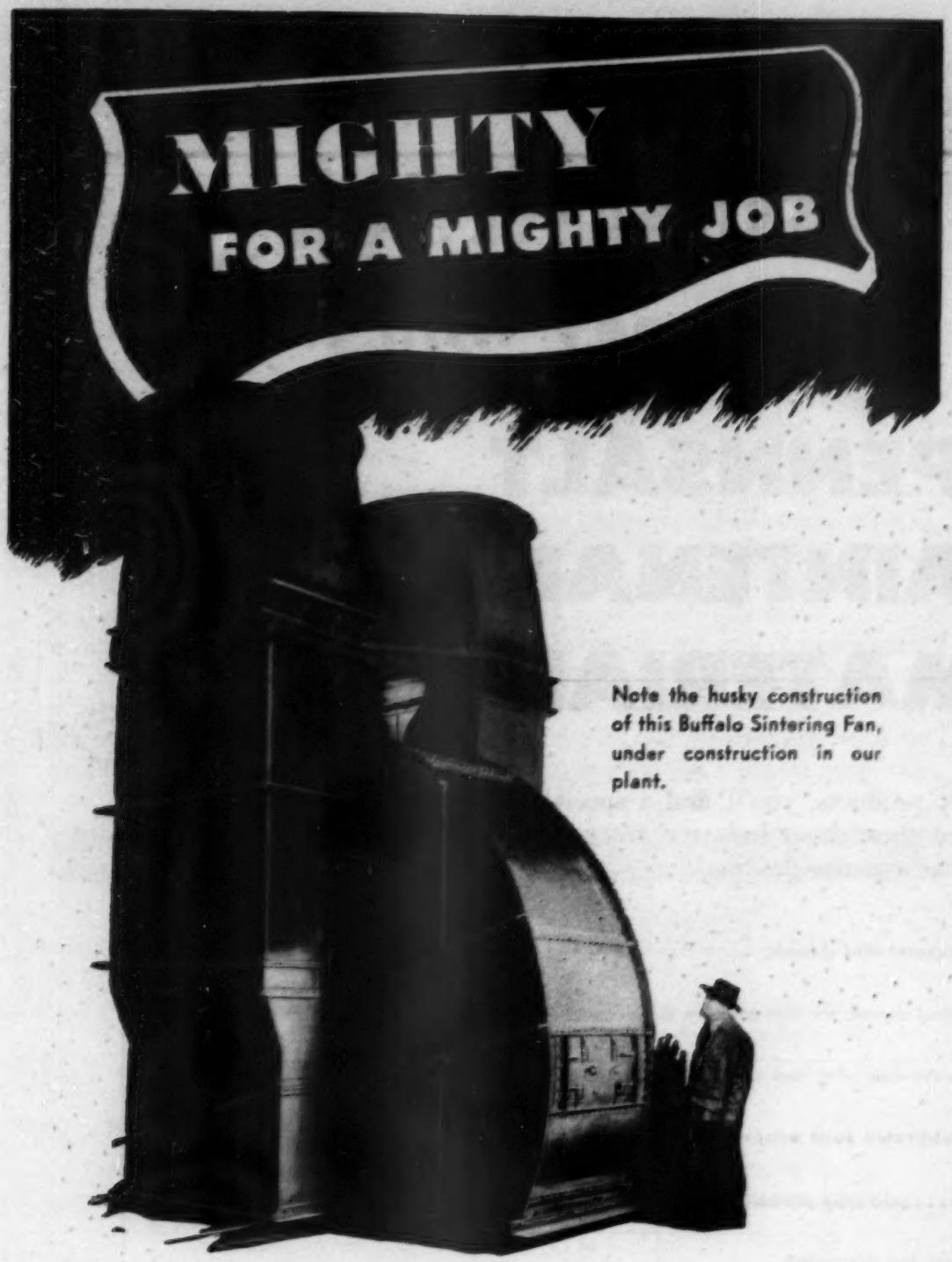

Note the husky construction of this Buffalo Sintering Fan, under construction in our plant.

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However, the engineering experience and the factory "know-how" which makes "Buffalo" the logical choice for such "extreme-service" jobs is also available to you on your everyday air-moving and conditioning work. "Buffalo" builds complete lines of ventilating fans, both centrifugal and axial flow, power plant fans, industrial blowers and exhausters for every service, and complete lines of air conditioning cabinets, central systems and unit coolers.

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"Buffalo" FANS for INDUSTRY

materials. Poor drainage, however, must be corrected to prevent major erosion which will undermine foundations or walls.

Columns

Troubles in columns usually show up first at the bases. Wooden columns will show rot; steel columns, rust; and brick columns, loose mortar, missing bricks, or defective pointing. As the building settles, or floor areas are overloaded, or mechanical injury occurs, or vibration becomes excessive, the effects usually show first at the bases of the columns. These warning points, too, may show that something more than routine cleaning and painting is needed. It may be that major structural repairs or remodeling will be necessary to offset the effects of vibration, grouping of machines, or traffic greater than the conditions for which the building was originally designed.

Floors

Floors are a maintenance specialty in themselves. The effects of heavy trucking, changing the direction of traffic flow, inadequate support, settling, improper drainage, acid conditions, overloading, vibration, or just long, rough usage all have their own symptoms.

Repair a break in a floor at once to avoid a major overhaul. There are many compounds for concrete floors which, if properly applied when the hole or crack has been thoroughly cleaned out, will prevent further trouble. Patching with concrete, even if well done, may result in quick cracking out if loads on the floor are heavy. Plastic compounds for floor repairing, generally, are more satisfactory.

Asphalt or composition floors may be best repaired with the same material or with patching compounds specifically designed for the type of flooring. Heat is usually needed to set the patches so that they will give satisfactory service.

Wood block floors are perhaps the easiest of all types to maintain. Blocks may be replaced, repaired, or holes filled with a plastic compound. The same alternatives are open to the maintenance gang with wooden floors. Planks may be pulled out and replaced with new

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24 hours a day "Old Man Weather" threatens roofs. Sun, rain, snow, hail, and corrosion cause blisters, peeling, dried felts, alligatoring.

Liquid Aluminum helps even the best roofs ward off these constant attacks. Coatings made from Reynolds Special Roof Coat Pigments form a metallic umbrella of thousands of tiny interlocking flakes of pure aluminum . . . reduce temperatures under the roof . . . seal out moisture . . . resist corrosion. Roofs of factories, schools, stores, and public buildings when protected with liquid aluminum, last longer, need less attention.

For best results, insist on aluminum roof coatings of standard quality made from Reynolds Special Roof Coat Pigments formulated only with a proper type of vehicle.

These outstanding pigments are the results of years of research by expert Reynolds technicians. Back of them is the knowledge developed through a quarter-century experience, plus complete quality control throughout every step of production from mine to pigment.

Reynolds technicians will gladly work with you on your coating problems. See your supplier for details, or write Reynolds Metals Co., Pigment Division, 19 E. 47th St., New York, N. Y.

REYNOLDS METALS

REYNOLDS ALUMINUM PIGMENTS

ROOF COATINGS OF LIQUID ALUMINUM

1623-P6-1B

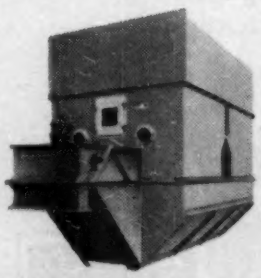
Eats DUST and FUMES from YOUR production

Schmieg CENTRI MERGE

DUST and FUME Eliminator

AUTOMATICALLY

- **COLLECTS** —*at point of origination.*
- **CLEANS** —*by high pressure water action.*
- **DISPOSES** —*by mechanical conveyor in the form of sludge.*



Like a huge octopus, with its tentacles (ducts) reaching out to every working area where contamination of air occurs, the Schmieg CENTRI-MERGE Eliminator sucks up and consumes all dangerous dust and fumes—literally eats them up.

Picked up at the point of origination—BEFORE *any damage can be done*—dust and fumes ride an air stream through the ducts to the Collection Unit. Here CENTRI-MERGE goes into action—washing—scrubbing—pounding out the dust and dirt in a tornado of cleansing water. Dust particles are deposited—under water—in a sludge tank at base of Unit.

Right now — today — CENTRI-MERGE Eliminators are removing the hazard of dust and fumes from scores of plants—doing a more thorough job than any other method—and doing it more economically. We welcome the opportunity of proving what CENTRI-MERGE can do for you.

THE *best* AIR PURGE *is* CENTRI MERGE

Schmieg INDUSTRIES INC.
Engineers & Manufacturers

309 PIQUETTE AVENUE • DETROIT 2, MICHIGAN

ones or the holes may be filled with asphalt compounds.

When changes have been made in traffic on floors or in the layout of machines, the inspector can frequently spot the places where maintenance will be a problem. Best solution may be to lay steel plates over the area.

Stairs and Aisles

Stairs and aisles where pedestrian traffic is heavy are a never-ending problem for maintenance men and inspectors. From top management's viewpoint, it is far cheaper to provide good maintenance than to run the risk of injuries.

Worn stair treads must be replaced. Railings must be firm. Slip-proof treads must be slip-proof. Holes or cracks in which heels might catch must be eliminated.

Interior Walls

The building inspector's report should have a special section covering interior walls. Although walls need not be checked on the inside as closely as on the outside, nevertheless, they may reveal all kinds of trouble.

Aside from the obvious damages, such as broken hardware, broken glass, loose partitions, holes in plaster, and flaking paint, walls will reveal structural stresses and evidence of exterior damage. Continued spreading of cracks on inside walls requires thorough investigation. It may result from more or less normal shrinkage or settling, or it may indicate serious settling, inadequate footings, and the need for a real overhauling of the building foundations.

Water stains on the plaster or ceilings usually indicate a crack extending all the way through the wall. Locating the crack or hole in the outer walls or roof through which water is coming, may require a thorough examination. Moisture may be coming through hair cracks or other small openings which must be sealed.

Roofs

A roof is something more than a 20-year guarantee. Guarantee or no guarantee, it will last a lot longer with regular inspection and regular maintenance.

Take time enough to go over the roof almost inch by inch. Repair

INSTALL *longer life* FEDERAL Cold Cathode

FLUORESCENT LIGHTING

for *adequate* illumination levels and reduced maintenance costs

FEDERAL precision-built lamps and fixtures are fully guaranteed for one year (except lamp breakage).

Industrialite

Extremely high reflector efficiency, over 91% in the four lamp model. Designed for easy installation, these units may be used in continuous rows to reduce service wire requirements. *One* three wire outlet required for *72 feet* of 4 lamp units.

Curvelite

Maximum diffusion with minimum loss of efficiency. Louvers have hinging action for easy lamp accessibility. This attractive fixture is one of Federal's full line available for office or other locations requiring well diffused lighting.

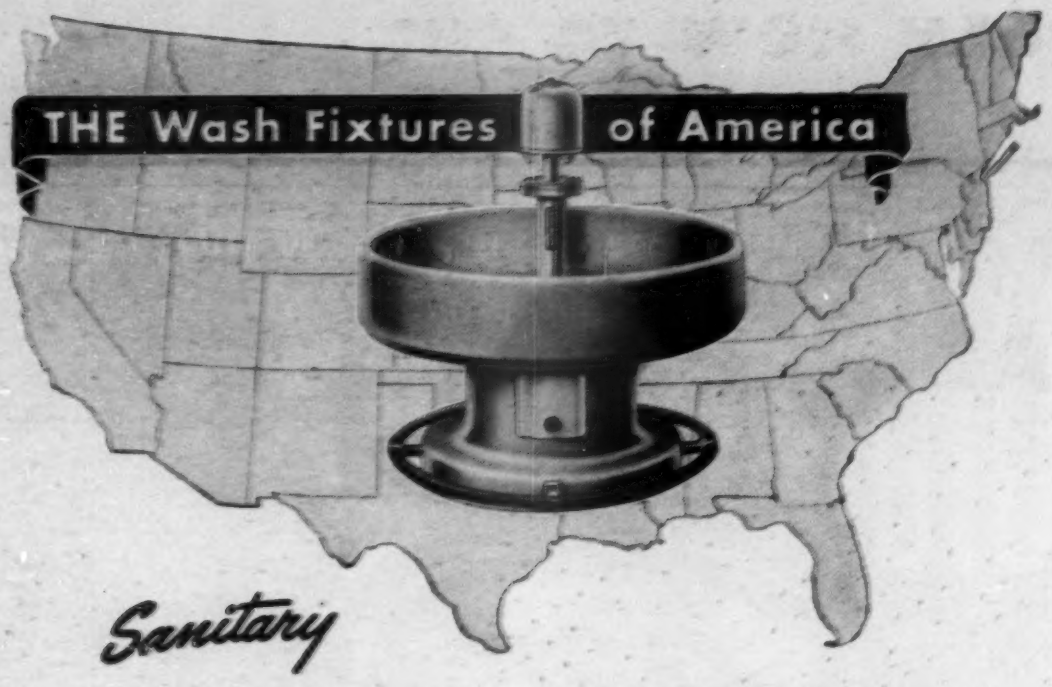
A complete line of newly styled, precision engineered Federal fixtures is *immediately available* for every lighting need.

Special finishes available for units exposed to corrosive atmospheres.

For further information and prices, address Lighting Division

FEDERAL ELECTRIC COMPANY, INC.

8700 South State Street • Chicago 19, Illinois



Sanitary

BRADLEY WASHFOUNTAINS

Why Have Bradley Washfountains Become So Universally Accepted and Used?

Some say: "Why, the unusual sanitary features of course." Others insist: "The elimination of faucets and multiple piping connections sold me on the economy of installing and maintaining Bradleys." While still another group insists: "We wanted the best available all-round fixtures for our employees."

Additional incentives for choosing Bradleys are the savings in water consumption, conservation of floor space, and no loss of time waiting to clean up.

Each Bradley accommodates 8 to 10 workers simultaneously and conveniently. The bowl is set low to enable workmen to wash hands, face, arms, and to the waistline—comfortably, in the shortest possible time. Furthermore, the fresh, clean spray of running water is easily turned "on" and completely turned "off" by a touch of the foot-control. To learn more about these unusual Bradley fixtures, send for Catalog 4308 and Washroom Survey Sheet. BRADLEY WASHFOUNTAIN CO., 2215 W. Michigan Street, Milwaukee 1, Wisconsin.

And Here's the NEW **DUO-WASHFOUNTAIN**

Each DUO does the work of two conventional wash basins. Serves two persons simultaneously. Eliminates faucets and reduces number of piping connections. Has automatic foot-control; hands touch nothing but clean running water. Easily-cleaned sprayhead, self-flushing bowl. Ideal for general office washrooms.

Write for Bulletin No. 464-D

BRADLEY *washfountains*

Bradleys are Nationally Distributed Through Plumbing Jobbers.

crews, on large roofs, may even follow the inspector as he works. Finally, it is a good idea to re-inspect the roof after it has been repaired. Leaks through a small hole may cause cumulative damage to columns, trusses, girders, and other structural parts. And such damage may not be detected until a heavy storm drives through enough water to stain walls or ceilings.

Examine every part of the roof for possible openings, nail holes, bulges or blisters, separation of seams, drying out of paper covering, cracks, or other deterioration.

Inspect flashing carefully—particularly the wartime sheet-steel flashing. See that seams between flashing and the roof or wall are tight and thoroughly sealed. Examine flashing for pinholes and particularly for corrosion, since it is usually not possible to paint the underside of the flashing. Check gutters, ducts, downspouts, and their retaining straps, bolts, and nails. Ventilators, penthouses, skylights, and vents in the roof are likely sources of leakage troubles.

A built-up or rolled roof is vulnerable in many ways. Check it closely to see that seams are not opening, raised, or cracked. Bubbles and dried-out spots must be taken care of. Bubbles must be cut, smoothed, and patched. Remove any area that is suspected of leakage, usually including all the area covered by the original coating.

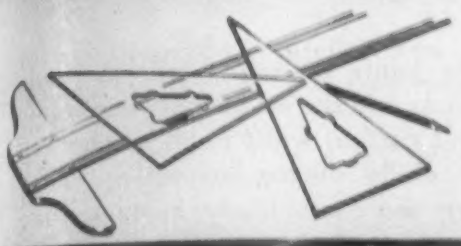
Exterior Walls

Now consider the exterior walls. Because every inch of the outside is exposed to weather, check it from coping to groundline.

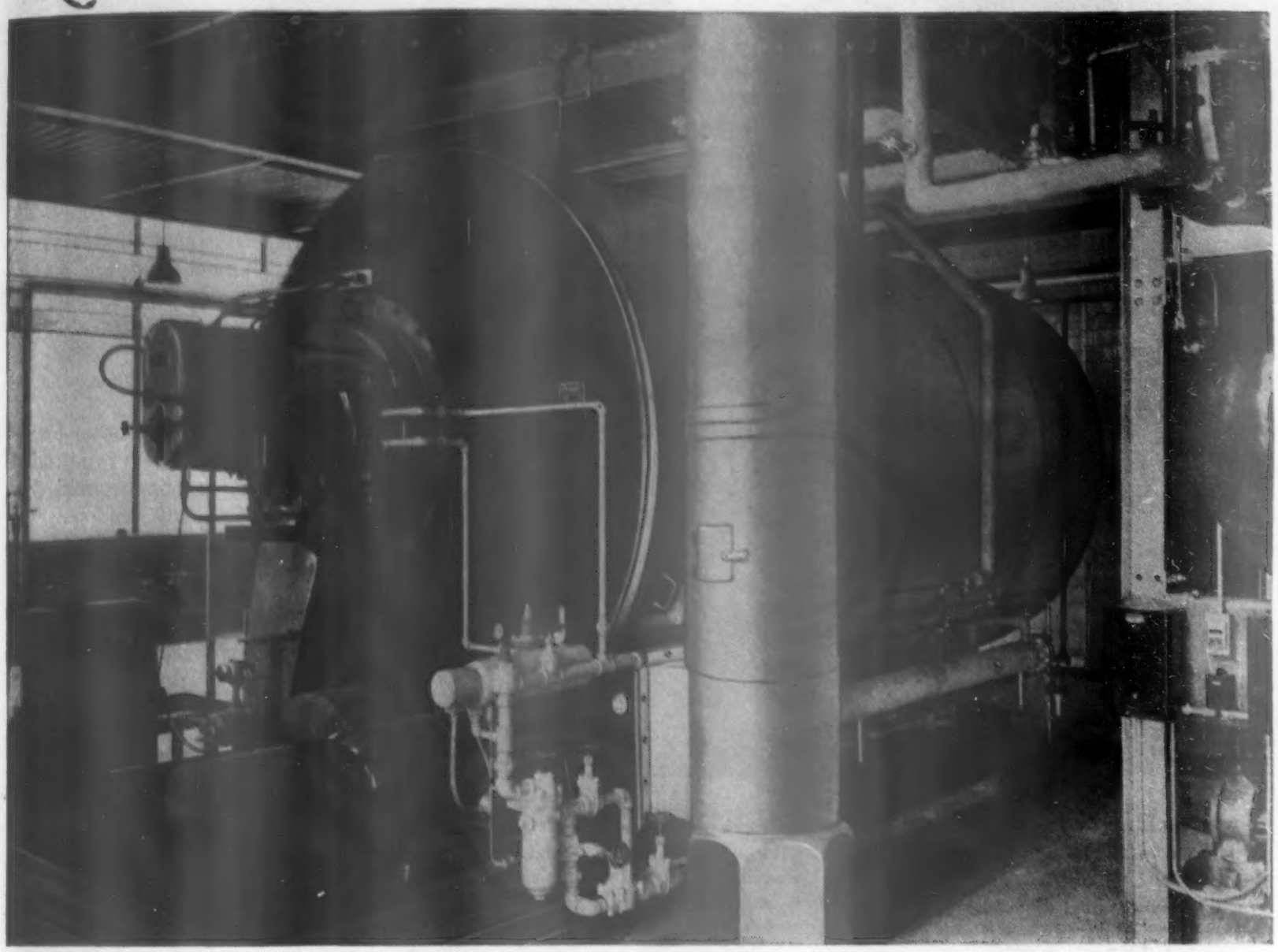
While checking the roof, look over the parapet or coping. Cracks in the coping stone or tiles or open joints between the wall and the roofing frequently allow water to work down into the walls. Replace loose, broken, or disintegrating tiles. Check and calk joints if necessary.

Cracks caused by settling are perhaps the biggest problem in maintaining exterior walls. The inspector can check them carefully, working in a boatswain's chair or from ladders. These cracks must be cut out and sealed with an elastic calking compound to allow for future movement. Other cracks, caused by shrinkage, may be sealed by pointing or calking.

Window and door openings and



PLAN NOW TO CUT YOUR STEAM COSTS...



Gain a Clean, Efficient Boiler Room . . . Lower Steam Costs . . . with a Cleaver Brooks Steam Generator . . . planned for Your Needs

Lower Steam Generating Costs Lead To Lower Production Costs . . .

CLEAVER-BROOKS Steam Generators are "tailored" for their job. They are installed to meet an individual plant's needs; Cleaver-Brooks puts unit into initial operation, instructs as to operation, care, and maintenance.

No recommendations are made until sufficient facts and figures have been compiled and a careful analysis completed of your steam requirements on the basis of today's load and tomorrow's anticipated need.

With this information, the most economically sized steam generator and related equipment to handle the load is then determined.

Application engineering, plus basically sound design and construction means that the maximum of value is provided from the day your Cleaver-Brooks Steam Generator is installed.

Self-Contained and "packaged"—

Delivery consists of a "packaged" unit. Connections to service outlets are all that is needed. No smokestack is used — a simple vent carries away all products of combustion. No extra foundation is required. Compact—the unit fits into limited space and low headroom locations. Sizes: 22 models — 15 to 500 hp; pressures 15 to 200 lbs. p.s.i.

Money-making performance—

The Cleaver-Brooks Steam Generator is designed for easy operation and low upkeep cost. Operation is at 80% efficiency from full load down to 30% of its rating. The high heat transfer from the 4-pass, down-draft boiler produces fast steaming. A boiler room as clean as the home or office is possible through use of oil for fuel.

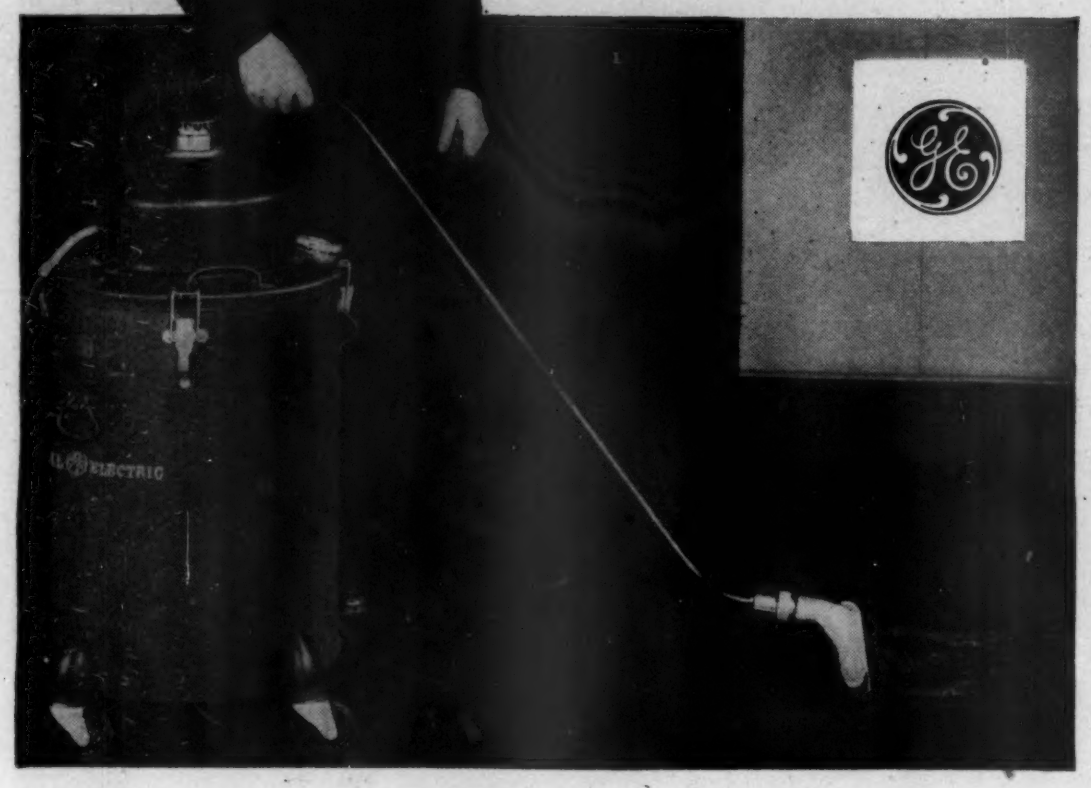
CLEAVER-BROOKS COMPANY, 362 E. Keefe Avenue, Milwaukee 12, Wisconsin

WRITE on your business letterhead for the Free Steam Cost-Calculator —a ready-reference slide rule showing the comparative steam costs when using oil or coal as fuel.

Cleaver-Brooks
STEAM
GENERATORS

Reduce Your Cleaning Costs!

Check these advantages of the New General Electric Commercial Vacuum Cleaners.



HERE is a quick, sure way to reduce man-hours . . . to lower costs . . . in heavy-duty cleaning.

These vacuum cleaners are built and tested by General Electric, world's largest manufacturer of vacuum cleaners. They are equipped with the dependable General Electric motor and backed by the company warranty.

General Electric provides prompt dealer service in repairs and replacement of parts—plus the special tools which make inaccessible places easy to clean. This machine can be operated by one person with no previous training.

Two models are available—combination wet and dry pickup models—or dry pickup models. For further details, mail coupon below. General Electric Company, Bridgeport 2, Conn.

FAST • EFFICIENT • QUIET • ECONOMICAL

The New General Electric

Commercial Vacuum Cleaner

GENERAL ELECTRIC

A & M Department, General Electric Company, Bridgeport 2, Conn.
Sirs: Send me descriptive literature concerning the

( ) Combination Wet and Dry Pickup Vacuum Cleaner
( ) Dry Pickup Vacuum Cleaner
( ) I would like a demonstration of this machine.

NAME OF INDIVIDUAL .....

NAME OF FIRM .....

ADDRESS .....

CITY..... STATE.....

227-151

the joints between walls and columns and the seams between frame and curtain walls must be checked carefully during inspection. They are the most likely spots to find cracks and the greatest sources of trouble. Anything that projects through wall surfaces, such as exposed reinforcing rods, offers weather an opening. These places must be covered, calked, or otherwise sealed from the weather.

Steel siding must be checked carefully. Even though the paint on one side is in good condition, water may have seeped through seams or joints and rusted the other side. Fastenings, inside and out, must be inspected to be sure they are tight and free from rust.

Glass brick walls, like other brick walls, need a going-over periodically. Bricks may be broken, the sealing material may be loose, or leaks may have developed around the frames.

Doors

Doors and entrance ways probably take more hard usage than any other part of the building. Hinges, fuse links, latches, stops, or other hardware may be loose, broken, or missing. Counterweights may be defective. Door frames frequently are damaged from bumping by trucks. Any cracks between frames and the wall or around lintels must be cut out and calked. Broken glass should be repaired and windows should be cleaned.

Windows

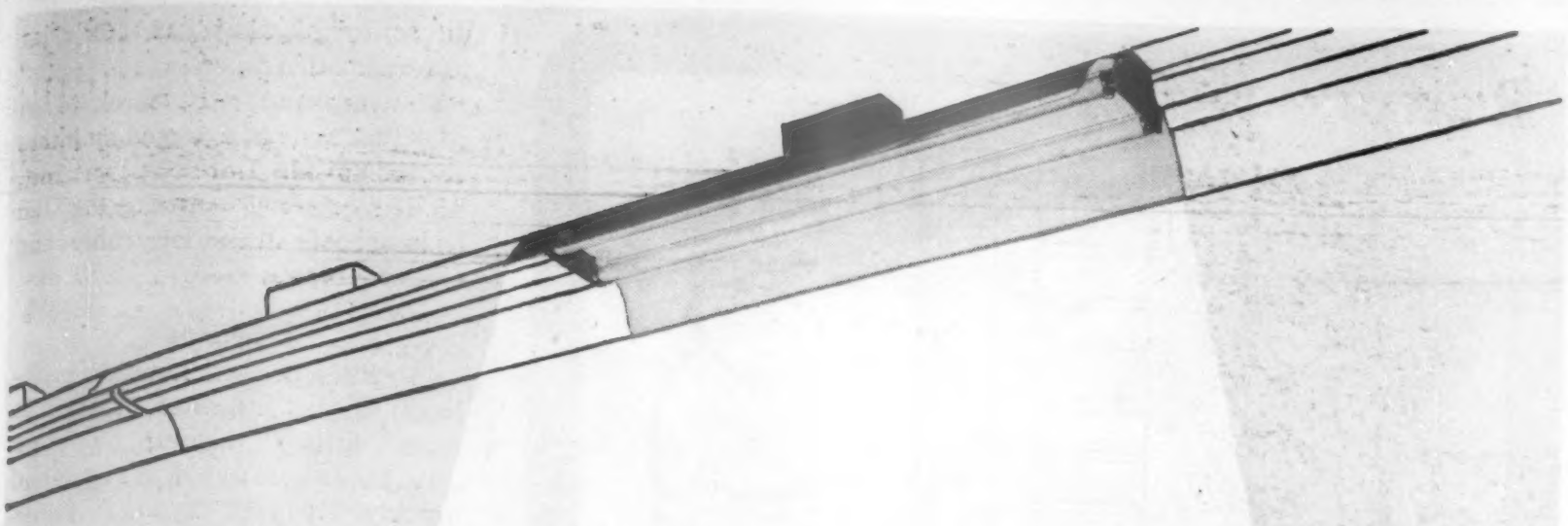
Windows, like doors, take a lot of abuse. The inspector may find evidence of leakage around frames, may find frames rotting or rusting. Paint and calking will fix the most obvious troubles.

Fire Escapes

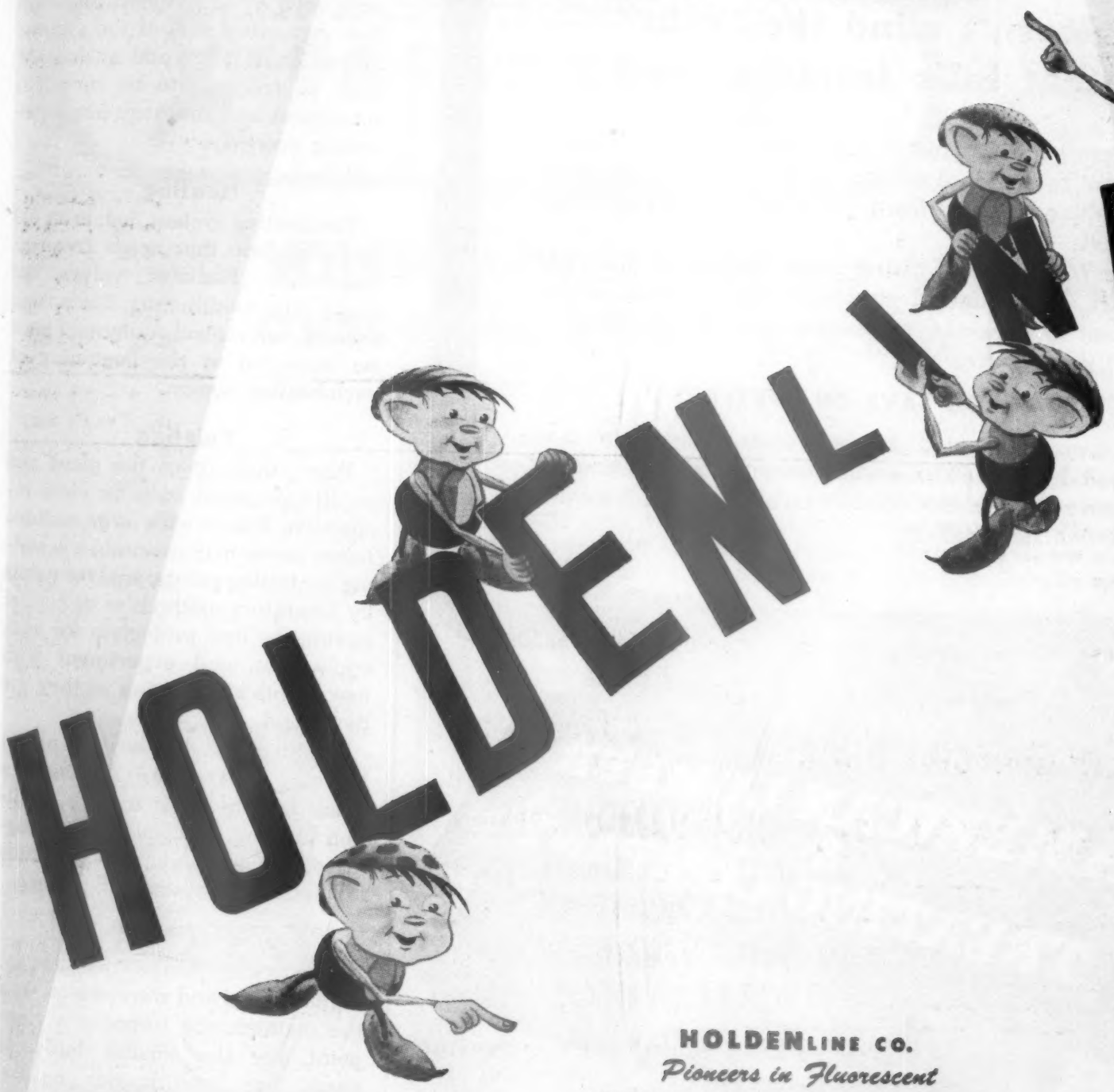
Fire escapes, water towers, and other metal work must be examined in the maintenance inspection. Fire escapes must be checked for safety, accessibility, functioning of lift sections, and rust. Water towers must be examined for leakage, defective control devices, faulty valves, and rusting. Weathering, wind damage, and mechanical failure are problems that must concern the inspector.

Loading Platforms

Loading and shipping platforms are frequently abused and may be



CHAN'L-RUN
The Basic Unit System



HOLDENLINE CO.
Pioneers in Fluorescent
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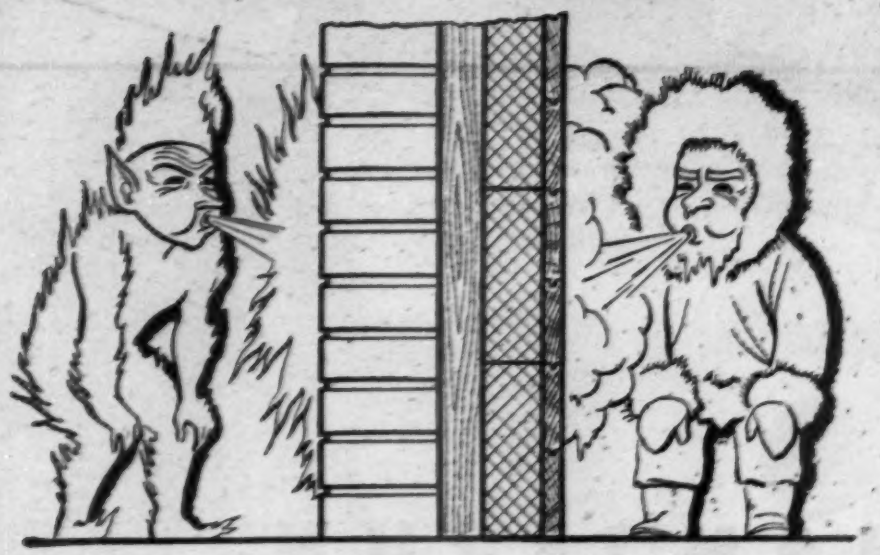


WOLMANIZED LUMBER*

doesn't mind the "rain" that falls inside a wall

Moisture squeezed out of super-cooled air is always a problem in refrigerated structures. And that moisture (or melting ice and frost) plays havoc with ordinary materials.

Use Wolmanized Lumber there and decay can't get a start. It's standard structural lumber made highly resistant to decay by pressure-treatment with Wolman Salts* preservative.

YOU SAVE ON UPKEEP

This pressure-treated lumber costs little more than untreated wood. You save money by eliminating expensive replacements. There's no odor. And this treated wood can be painted.

*Registered trademarks

1676 McCORMICK BUILDING, CHICAGO 4, ILLINOIS

the source of many minor injuries to personnel.

The inspector must check to be sure that nails and jagged splinters are removed. Loose planking, broken columns, and sagging and leaking roofs all call for prompt and effective repair.

Pipelines

Pipelines present familiar problems to the inspector. Leaks in pipes, fittings, valves, or other equipment must be repaired quickly. Hangers, expansion joints, and valves need periodic inspection. Both wet and dry sprinkler systems must be tested. Both ends of the system should be opened to be sure that flow through the system is unobstructed.

General piping and plumbing systems need more frequent attention than any other part of the system. Inspection of toilets and washrooms must be frequent to be sure that equipment and drainage are functioning properly.

Heating

The heating system, too, is an old story but one that needs frequent inspection. Radiator valves, air vents, air conditioning ducts, unit heaters, and control equipment must be inspected at the beginning of each heating system.

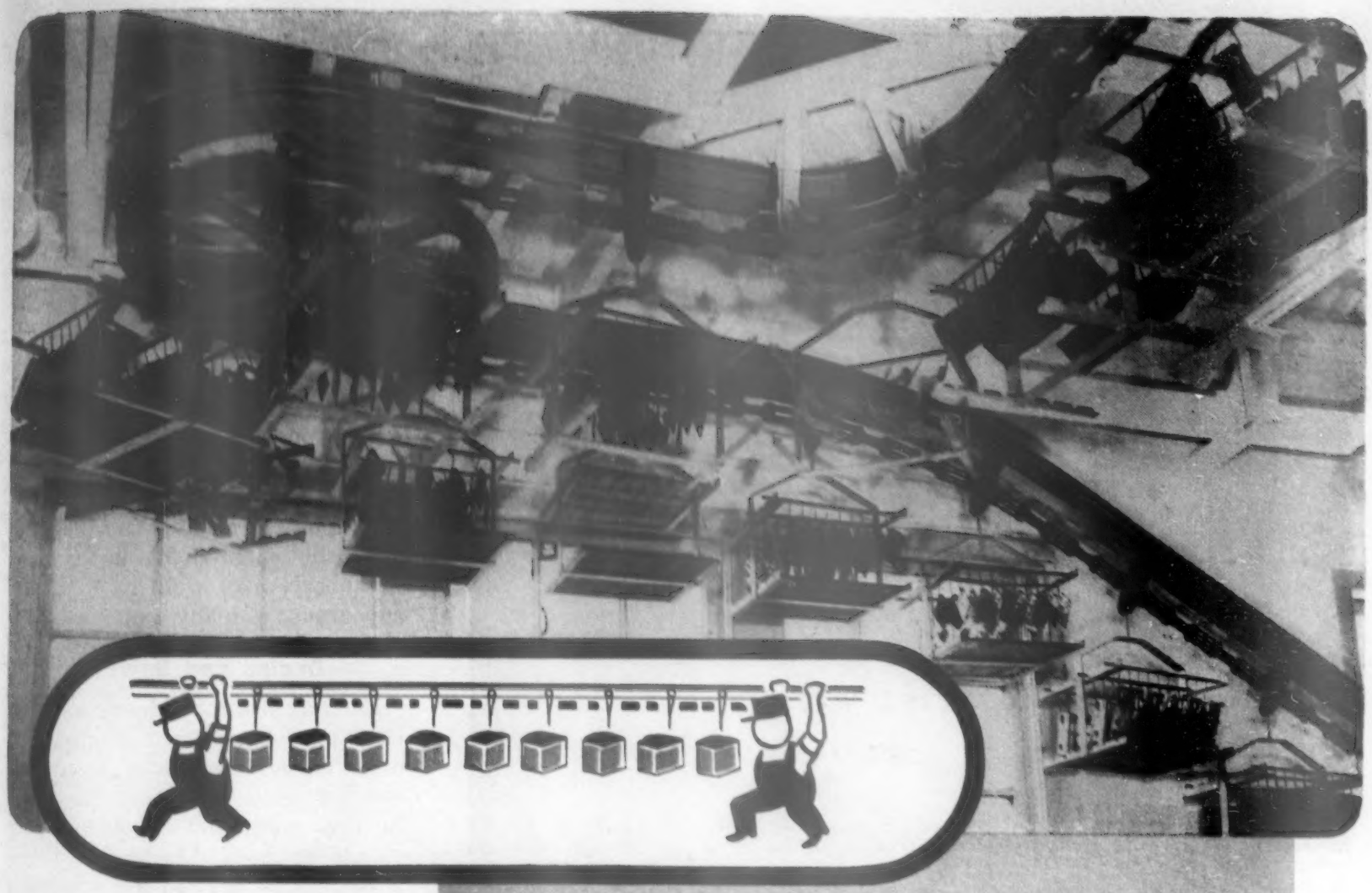
Painting

Paint, throughout the plant and on all equipment, calls for close inspection. Plants with large maintenance crews may maintain a schedule for testing paints, analyze paints by laboratory methods to be sure of having the best protection for each application, and experiment with new paints and finishes as they are developed.

In many of the smaller plants, however, the inspector must assume much responsibility for the condition of paint. He must check surfaces, corners, and joints carefully for flaking, chipping, and scaling.

Smaller Buildings

Just as important as manufacturing buildings and warehouses, from the maintenance inspector's viewpoint, are the smaller buildings, sheds, fire hose houses, outdoor transformer installations, and similar isolated structures. They are exposed to the same weathering as the main buildings, need the same care,



WHEN MATERIALS GO OVERHEAD OVERHEAD COSTS GO DOWN

There's a close link between overhead costs and overhead trolley conveying systems as designed and built by Gifford-Wood. There's the safety assurance when work in process and finished materials travel overhead the G-W way: men are far less liable to get hurt and require costly time off. There's the increase in floor space made available by relieving congested work areas when you let G-W install an arrangement of automatic overhead trolley conveyors. Carriers and hooks are designed to fit specific products.

What's more, in addition to overhead trolley systems, G-W supplies other types of material-handling equipment —apron, flight, chain, belt and screw conveyors, carriers and elevators. For G-W is a material handling specialist, with more than 130 years' experience in making materials move—the fast, safe, space-saving way. That's evidence aplenty that G-W can solve any material handling problem. Yours, for example!

Even if your problem is unique, G-W will design a conveying-elevating system to meet your requirements. Whether your product is large or small, G-W systems fitted to your plant layout can move it faster, easier, cheaper.

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faster • easier • cheaper

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